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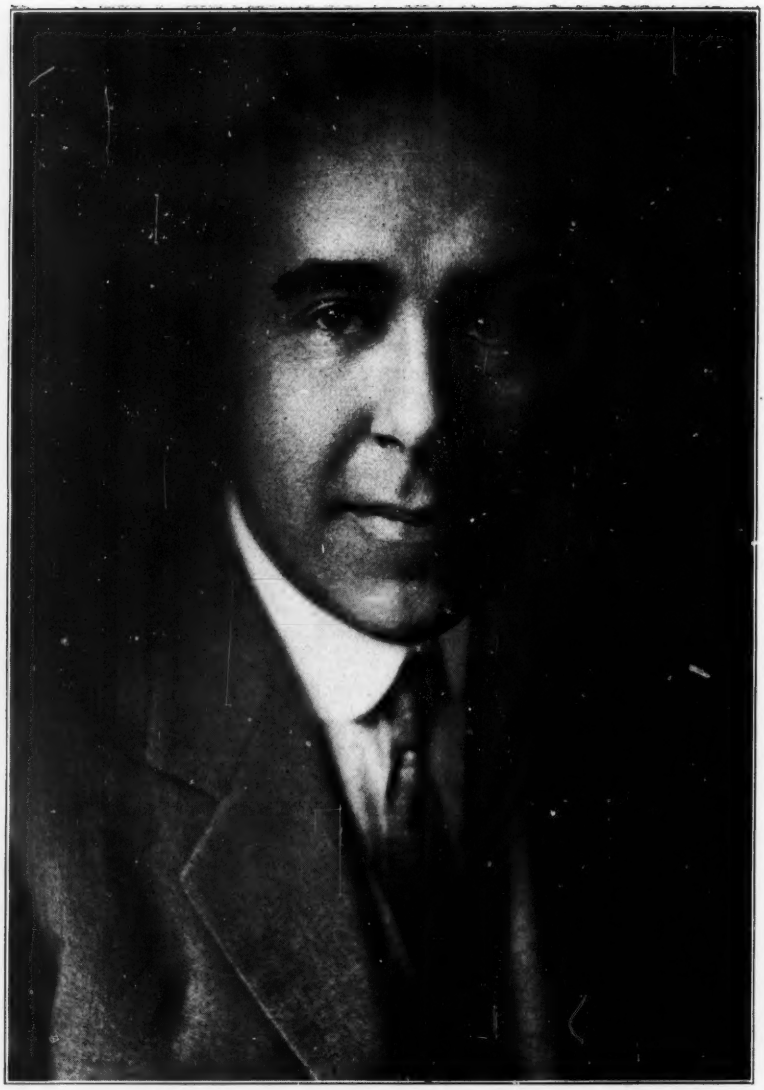

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Vice President of the American Dental Association

UNIV. OF MICH.

THE JOURNAL
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Original Communications

AN ANALYSIS OF THE DEVELOPMENT OF THE ARTICULATOR

By RUPERT E. HALL, D.D.S., Chicago, Ill.

MY discussions to follow in this paper are for the purpose of clearing up some of the misinterpretations, discrepancies and misrepresentations associated with the development of the articulator and the controversy that has arisen in connection with its development, sale and use. Wilful, unfair and unjust influences have been brought to bear in certain instances, and a controversy unwarranted and detrimental to science and progress has resulted. It is time that the profession know the facts and that the situation be changed from one of derogate influence to one that will attract the members of the profession to the subject rather than drive them away from it.

It is because of the lack of knowledge and understanding of the development of the articulator on the part of the profession that the present controversy regarding the articulator exists. The remedy for the correction of this situation depends on the members of the profession informing themselves on the subject. It is because of this fact that I have prepared this and my previous articles,[1] which I sincerely hope will be the means by and through which this unwarranted, personal, destructive and disorganizing situation will be likewise analyzed and ended. It is absolutely necessary that the articulator part (first part) of my first article and my second article be read before reading this article in order to fully understand the premise upon which articulator movements are based and compared in my articulator analysis.

In discussing the principles underlying the construction and workings of the different articulators of the past and present, together with the claims made for

1. Hall, R. E.: Full Denture Construction, J. A. D. A., 16:1157 (July) 1929; Analysis of Work and Ideas of Investigators and Authors of Relations and Movements of Mandible, ibid., 16:1642 (Sept.) 1929.

them by their designers,[2] sponsors and users, it will be necessary to review the history of the development of the articulator that we may refresh our memories with the origin, construction and workings of each instrument so that credit may be given where due and a fair and impartial analysis may be made.

In this review and analysis, I shall discuss the work of each designer of articulators in chronologic sequence. In my investigations, I find that the work and articulators of the following designers are mainly responsible for the development of the articulator:

Gariot: Guerini[3] gives credit for the original invention of the articulator, a

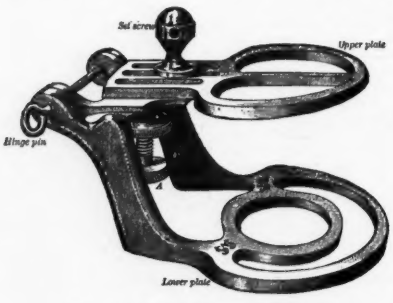


Fig. 1.—Plane line articulator.

simple hinge movement known as a plane line articulator, an example of which is shown in Figure 1, to J. B. Gariot. This instrument was constructed in about 1805.

The movement of the Gariot articulator is one dimensional and the instrument therefore is a one-dimensional articulator.

Gariot evidently assumed this one movement, opening and closing, to be all that it was desirable or necessary to reproduce in an articulator; and he believed that casts mounted in it were moved in correct relation relative to each other, as guided by the hinge joint, without definitely relating (mounting) the casts to the axis of the articulator.

This apparent assumption and practice (mounting casts in articulators arbitrarily) prevailed until Snow[4] devised and introduced the face-bow and technic for its use for the placement of the casts in

Fig. 2.—Snow face-bow.

the articulator in the same relation to the hinge joint (axis) as the jaws bore to the axis (hinge) in the patient (Fig. 2). To Snow, therefore, goes the credit for first perfecting equipment, together with a technic, for the orientation of the casts in the articulator in definite (three-di-

2. Designers are those who originated articulator construction for reproducing relations and movements of the mandible.

3. Guerini, Vincenzo.: Historical Development of Dental Art, Dent. Cosmos, 43:3 (Jan.) 1901.

4. Snow, G. B.: Present Status of Articulator Question, Dentist's Mag., 2, 1906-1907.

mensional) relation to its hinge joint. Quoting from Snow's article:

Dr. Hayes invented an appliance which he called an articulating caliper (Fig. 3). This is the first instrument on record to be used for locating the casts in their proper position in the articulator. Dr. Bonwill located the casts by means of dividers, setting the mesial line of the trial plate at four inches from the condyles or joints of the articulator, this being the average measurement as he found it in his investigations. But there is a great difference in this dimension, the variation amounting to about an inch. Therefore, the only way in which the casts can be correctly located is by means of some instrument which will take the measurement from the patient for whom the dentures are to be constructed, and transfer it to the articulator. Dr. Hayes' instrument for this purpose was ingenious, but it did not meet all conditions. It simply enabled him to set the mesial line of the labial surface of the trial plates in their proper place, and if there was any lateral deviation, which is sometimes the case, it was not taken into account. The rear of the casts might be elevated, depressed, or swung laterally in the articulator without interfering with the measurements secured with his caliper, and to this extent there was a chance of considerable error. Notwithstanding the merit there was in Dr. Hayes' devices, they failed to attract notice, and it is doubtful if they were used by any but himself.

In 1894, George K. Bagby,[5] of Newbern, N. C., obtained a patent showing an articulator of the ordinary construction, having attached to its joint pin a removable arm by which a measurement could be taken from a condyle of the mandible to the mesial line of the trial plates, and this measurement be transferred to the articulator (Fig. 4). This is a more simple device than that of Dr. Hayes', but it does not seem to have been very effective.

As an aid in establishing the correct relation of the casts to the opening and closing axis of the articulator in conjunction with the use of the face-bow, Snow established two planes of orientation with relation to the facial line according to Broomell's[6] basal line and plane of occlusion of the teeth (Fig. 5).

Snow described Broomell's planes of orientation as follows: one, a plane represented by a line, *B*, Figure 6, drawn from the floor of the auditory meatus (tragus) touching the root (ala) of the nose; the other, a plane represented by a line, *A* (occlusal plane of the teeth), running parallel with the line *B*.

The mouth piece of the face-bow is mounted on the upper bite rim so that its stem is parallel with the line *A* or the occlusal plane (Fig. 7).

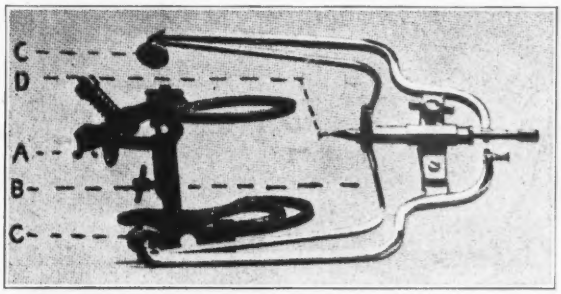


Fig. 3.—Hayes articulating caliper.

5. A "Dental Articulator Patent, No. 522,188," was granted to George K. Bagby, July 3, 1894.

6. Broomell, I. N.: Value of Temperamental Indications in Correct Prosthesis of Entire Dentures, Dent. Cosmos, 39:1 (Jan.) 1897.

Broomell, we believe, is the one to whom credit indirectly belongs for suggesting the use of the plane of orientation known as a line from the tragus to the ala of the nose for assisting in establishing the occlusal plane of the teeth. Broomell first indicated this line with reference to the osseous structure, and Snow gave it a name that applied to the anatomy of the soft tissues.

Quoting Broomell:

To properly study the cranial and facial contour, some fixed position must be established for the cranium before attempting to outline the profile. For this purpose the lines forming the facial angle may be used (Fig. 5). A fixed line representing the base of this angle may be drawn from the center of the glenoid fossa, passing forward through the anterior nasal spine, or base of the nose, and the angle is completed by a perpendicular line resting upon the labial surface of the superior incisor teeth, passing upward and touching the most prominent part of the forehead. In the Caucasian or white race, this angle varies from 75 or 80 degrees to almost a right angle.

The natural tooth-line level, without reference to the dip of the arch, is always horizontal to this basal line, and the contour wax models should be formed to correspond to this line. Not infrequently when the posterior teeth have been missing for a number of years previous to the extraction of those anterior, the remaining alveolar ridge will impart no information about the tooth-line level, and this must be ascertained by reference to the basal line.

The angles of the mouth, when at rest, should correspond with the occluding surfaces of the bicuspids, and in the edentulous subject they may be located by reference to the occluding surfaces of the contour wax models, when formed in accordance with the above ideas.

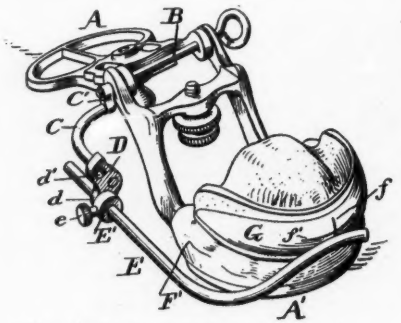


Fig. 4.—Bagby articulator and face-bow.

Daniel T. Evans, of Philadelphia, is given credit for developing the second articulator in the history of the development of the articulator, but, according to patent office records, James Cameron, of Philadelphia, was second in the list of contributors in its development.

Cameron[7]: April 30, 1840, James Cameron, of Philadelphia, was granted a patent for an articulator which he described as "a new and improved instrument for adjusting artificial teeth, so as to ascertain when their grinding-surfaces fit properly together and if they do not fit to show wherein they fail to fit."

Fig. 5.—Broomell's plane of occlusion.

The Cameron articulator (Fig. 8) provided means for horizontal and vertical adjustments of both the upper and lower arms of the articulator, amounting

7. A "Dental Articulator Patent, No. 1574" was granted to James Cameron, April 30, 1840.

almost to universal (three-dimensional) adjustment, shown and explained in my paper "Full Denture Construction"[8] under the heading "Adjustments for Centric Relation or Occlusion," in connection with the Hall three-dimensional articulator.

The Cameron articulator provided for but *one* movement of the mandible, the opening and closing movement, and was, therefore, a one dimensional articulator.

Evans[9]: Aug. 28, 1840, Daniel T. Evans, of Philadelphia, obtained a patent for an articulator which he described as "an instrument so constructed as to imitate the motion of the lower jaw, and to exhibit the actual relationship of the upper and lower teeth and gums to each other in the most perfect manner" (Fig. 9). He further states:

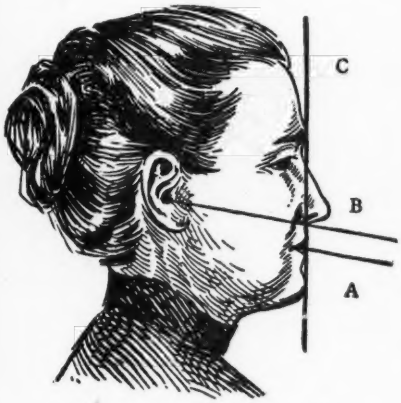


Fig. 6.—Snow's plane of occlusion.

In closing the jaws it will sometimes happen that the teeth will not be made to meet in perfectly natural manner, and the casts, therefore, would be subject to this defect were not provision made for adjusting the lower plate by allowing a motion at the joints *H*, similar to that which is admitted by the condyloid processes in the living subject; an arrangement has been made for effecting this object, which is shown in 3, (Figure 9), representing a top view of the apparatus at the upper part of the plate *E, E*. *K* is a bar of iron, upon the ends of which are the joint pins *H*, which pass through slots *a,a*. *L* is an adjusting screw by which the bar *K*, and, consequently, the plate *G*, can be moved backward and forward. The bar *K* has some lateral play upon the adjusting screw *L*, thus admitting either end of the bar to be placed somewhat in advance of the other, so as to give a cant to the plate *G*, toward either side; *b,b* are small thumb screws for holding the bar *K* in its proper position.

The Evans articulator was a two dimensional gothic arch type of articulator. It copied the principles of the Gariot articulator and added the improvement of imitating the protrusive, retrusive and lateral movements of the mandible. This articulator represented the condyles as moving in the horizontal plane. The Evans articulator possessed all of the features found in any of the present-day articulators (except the three-dimensional articulator) except adjustability for the variability of the downward movement of the condyle, the Balkwill-Bennett movement and incisal guidance. It is interesting to note that the thumb screws *b, b* for holding the hinge bar in its proper position, acted also as a means by which rotation points were established inside the condyles for the lateral movements exactly as later embodied in the Walker and Gysi articulators. Add to the Evans instrument made in 1840 a downward condyle path, and we have in principle a Gysi simplex articulator. Add an adjust-

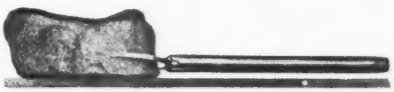


Fig. 7.—Snow face-bow fork.

8. Footnote 1, first reference.

9. A "Dental Articulator Patent, No. 1743" was granted to Daniel T. Evans, August 28, 1840.

J. Cameron,

Dental Articulator.

No. 1574. Patented Apr. 30, 1840.

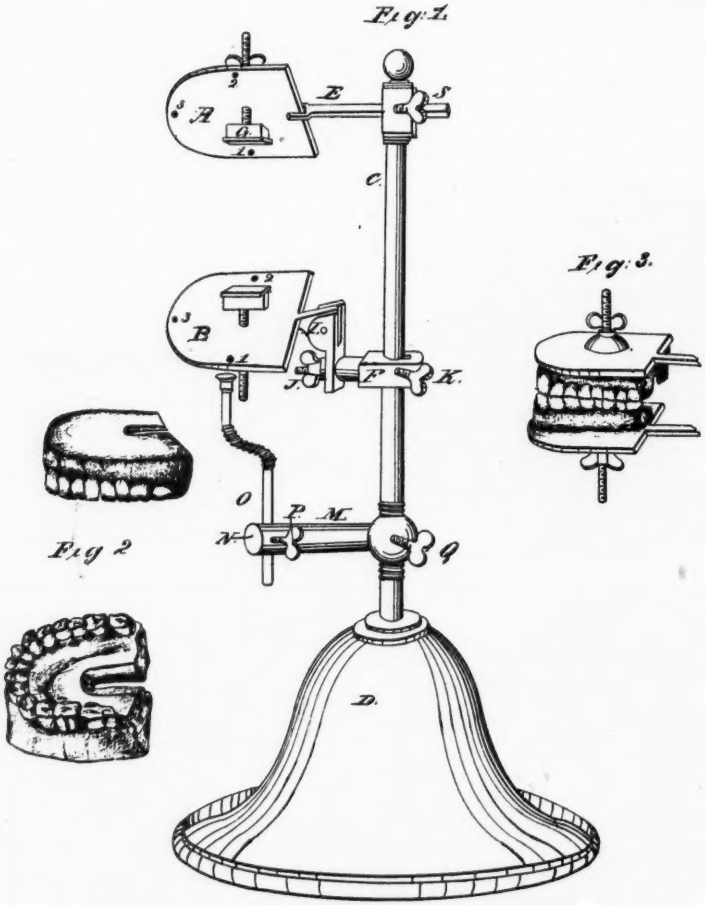


Fig. 8.—Cameron articulator.

able condyle path, and we have in principle the familiar and much used Snow (new century) articulator, made in 1907, or sixty-seven years later, while the simplex was made over seventy years later.

There was little progress made in articulator construction during the years intervening between Evan's work in 1840 and Walker's in 1896 as compared with that made since the introduction of Walker's work.

Bonwill[10]: In 1858, W. G. A. Bonwill, of Philadelphia designed his articulator (Fig. 10). Bonwill presented his instrument and studies of anatomic occlusion before the American Dental Association at Niagara Falls, N. Y., in 1864. Bonwill may be justly called the father of anatomic (balanced) three-point contact occlusion. Undoubtedly, his work inspired all later workers in this field of endeavor.

The Bonwill articulator was a two-dimensional gothic arch articulator.

While Bonwill is credited with being the father of anatomic or balanced occlusion, so-called, his instrument showed no advance in principle, as to movements, over the Evans articulator. Its design and construction made it much more usable and practicable, but, beyond this, there was no improvement shown. These instruments moved alike from both a theoretical and practical point of view, except for the slight difference pointed out in connection with the thumb screws, *b, b,* in lateral movements, which at that time had no significance.

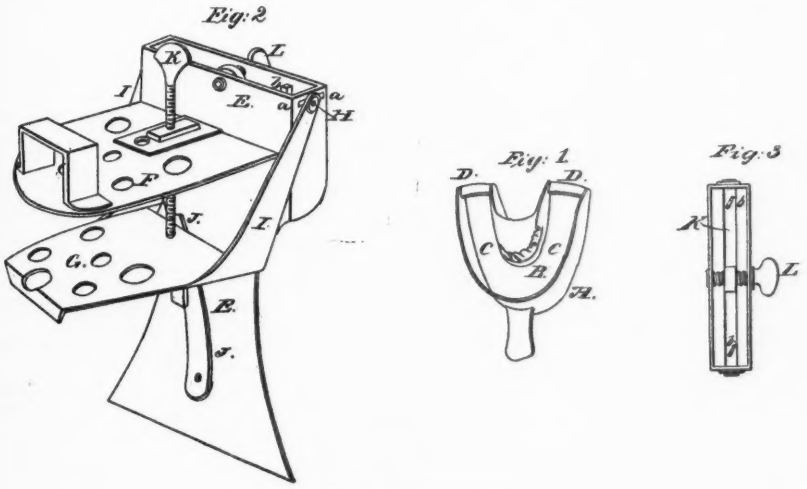


Fig. 9.—Evans articulator.

With the Bonwill articulator was first associated the equilateral triangle previously described.[11] Various investigators have pointed out that Bonwill's theory

10. Bonwill, W. G. A.: Scientific Articulation of Human Teeth as Founded on Geometrical, Mathematical and Mechanical Laws, Dent. Items Int., 21:617 (Sept.), 873 (Dec.) 1899.

11. Footnote 1, second reference.

of the triangle was purely hypothetical because mandibles were not found to conform to the equilateral triangle. It has been said that the only mandible that was ever found to be equilateral was the one measured by Bonwill. I have believed there was some connection between the triangle and the architectural design of the human masticatory mechanism, but I do not believe that Bonwill or any other investigator since his time has proved anything in this connection that has any direct or necessary advantage whatsoever one that understands it. The Hall arbitrary conical, the Monson arbitrary spherical and the Wadsworth variable arbitrary spherical (spheres) theories all belong to the same category as the Bonwill. The Bonwill and the Hall theories have long since been relegated to the archives of the past, and the Monson and Wadsworth theories are doomed and headed for the same destination, if, in fact, they are not now peacefully slumbering there, and we are hearing only the echo of their former existence. The

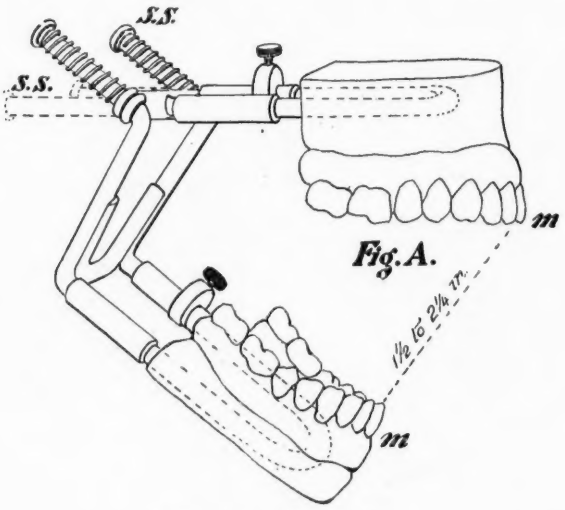


Fig. 10.—Bonwill articulator.

in the construction of dentures.

As with other purely geometric solutions of mandibular relations and movements since Bonwill's time, such as the arbitrary conical theory evolved by me and later the arbitrary spherical theory by Monson, and still later the variable arbitrary spherical (spheres) theory by Wadsworth, few understand just what Bonwill's geometric scheme is all about. In fact, I have been unable to find any authors and sponsors of these theories may not realize or agree with this, but it is true. Three-dimensional checkbites checked with a three-dimensional articulator and the articulator adjustments and movements observed will convince even the most skeptical that this is so.

Some day, a geometric figure may be shown to fit into the situation under discussion, but, for the present, we may well consider the geometry of the masticatory

mechanism a "closed book," as Christensen was broad minded enough to see and to allow for in his day in connection with the movements of the mandible. Christensen said, "It must be remembered that the minute details of the articulation's anatomico-mechanical nature are still a closed book to us, and for this reason are hardly suitable as the real basis for our line of argument."

With our knowledge of the movements of the mandible and the ability to reproduce them today, Christensen's statement may now be well applied to the geometry (so appropriated) of the movements of the mandible.

Hayes[12]: In 1889, Richmond S. Hayes, of East Bloomfield, N. Y., received a patent for an articulator (Fig. 11), which embodied one new feature, namely, registering downward movement of the condyle.

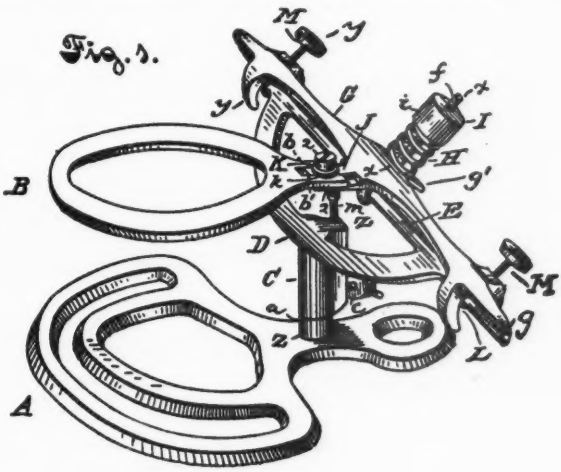


Fig. 11.—Hayes articulator.

The Hayes articulator was a two-dimensional gothic arch articulator. Other than for the improvement of downward movement of the condyles, this articulator was a copy in principle of the Gariot and the Evans instruments.

Now comes a complete and revolutionary change in the history of the development of articulators with regard to both the interpretation of mandibular movements and the construction of articulators.

Walker[13]: In 1896, William E. Walker, of Pass Christian, Miss., obtained a patent for an articulator with adjustable construction for imitating the variable downward movement of the condyle path, the variable centers of the

12. A "Dental Articulator Patent, No. 396,566" was granted to Richmond S. Hayes, January 22, 1889.

13. Walker, W. E.: Prosthetic Dentistry: The Glenoid Fossa: The Movements of the Mandible: The Cusps of the Teeth, Dental Cosmos, 38:34 (Jan.) 1896; Movements of the Mandibular Condyles and Dental Articulation ibid., 38:573 (July) 1896; The Facial Line and Angles in Prosthetic Dentistry, ibid., 39:789 (Aug.) 1897.

lateral movements and the variable center of the opening and closing movement (Fig. 12).

This articulator was a two-dimensional gothic arch articulator. Walker was the first investigator to call attention to the variability of the downward movement of the condyles, and the Walker articulator was the first articulator to embody the improvement of adjustable means for reproducing the varying angle of the downward movement of the condyles, which he designated the condyle path. Walker was also the first investigator to discover and to call attention to the fact that the centers or axes of the lateral

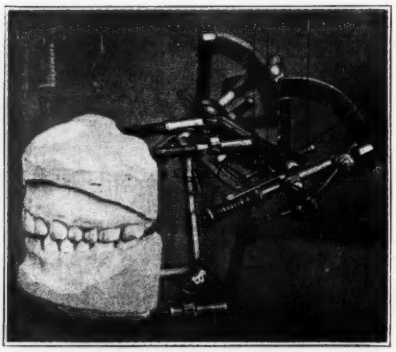


Fig. 12.—*E*, bite correcting fulcrum screw used to correct the bite when it is either too far forward, too far back or falsely to one side or the other; *F*, another fulcrum screw which can be instantly removed with its supporting frame *G*, as it is only used in correcting a bite which is too close or not close enough. *H* is divided in its center so that the condylo-occlusal angle of one side may be adjusted independently of the other. *G*, adjustable sliding collar which carries the bite correcting fulcrum screw *F*, which passes through a slot in *E*, so that it is always parallel with the bar *H*, which controls the condyle movement.

(horizontal) movements of the mandible varied, and the Walker articulator was the first articulator to embody adjustable construction for reproducing variable rotation centers for the lateral movements.

Figure 13 shows Walker's diagrammatic illustration of a lateral (horizontal) mandibular movement taken from his article, "The Facial Lines and Angles in Prosthetic Dentistry."

Thus did the so-called condyle path and rotation point theory come into being. Walker, we now understand, was the father of these much discussed principles. In these views of the Walker articulator and the diagram of the lateral movement, one sees the original articulator construction and geometric illustration made

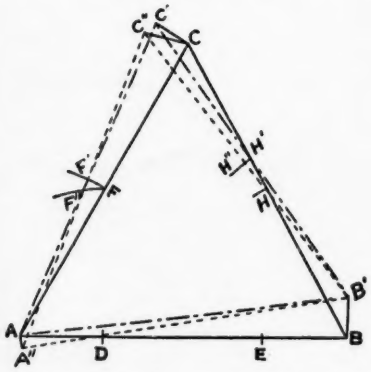


Fig. 13.—Walker's diagrammatic illustration of the lateral movement of the mandible.

familiar to us through the writings of Gysi and the advertisements of the Dentist's Supply Company.

Walker was also the first to provide means in the articulator for effecting forward and backward (eccentric) movement of the condyles in opening and closing the articulator when changing the bite.

In summarizing Walker's work, it is shown that he constructed an articulator that embodied every principle known to articulator construction, with regard to

movements, up to the time of the recently introduced three-dimensional articulator, except imitation of the curves of the condyle paths, the Balkwill-Bennett movement and incisal guidance.

When we take into consideration the fact that the principle of imitating the curves of the condyle paths is impracticable and has been abandoned, Walker's articulator is short but two principles only as exemplified in articulators discussed up to this time in the development of the articulator, namely, embodiment of the Balkwill-Bennett movement and incisal guidance.

Fig. 14.—Spherical curves or surfaces ground from plaster blocks with the movements of the articulator. (Christensen.)

From Walker's time on, investigators, authors and designers have been trying to locate the individual centers (axes) of the various movements of the mandible and to construct articulators with which to imitate, directly or indirectly, these centers, for the purpose of reproducing the individual movements of the mandible for use in restoring and correcting occlusion of the teeth.

Because of the prematureness of Walker's work, interest in his findings was lacking in the profession, and the principles disclosed by him were not taken up completely until Gysi made his critical and extensive investigation of mandibular relations and movements, corroborated Walker's findings and embodied them in his articulators. While Walker received more or less credit for his findings, he was never accorded the recognition, generally, that was and is due him. And in the commercial rush for articulator supremacy and control of articulator sales, Snow's and Gysi's names have been so heralded that poor Walker's name, together with his work, seems to have been submerged in such depths as to be forgotten completely, and his work accredited

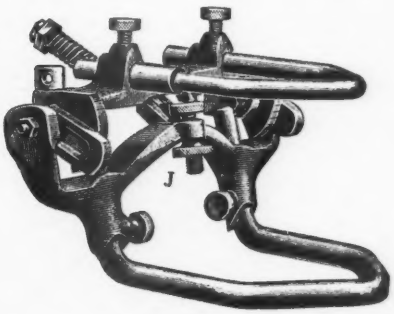


Fig. 15.—Snow new century articulator.

to Gysi. It should be a source of genuine satisfaction to all to know that at last this man's work was recognized and utilized and today he is again receiving by way of this publication the recognition that is due him.

Walker was the real pioneer investigator, author and designer, and to him actually belongs the credit for the principles now generally accredited to or assumed to belong to Gysi. Credit should be given where credit is due, and I am especially grateful for this opportunity to do my bit in seeing that the various investigators, authors and designers deserv-

ing credit for original contributions receive due and just recognition in particular. This, indeed, has a great deal to do with my purpose in writing this paper.

Christensen[14]: In 1901, Christensen introduced his articulator (Fig. 14). This was a two-dimensional gothic arch articulator, which copied the Gariot and Evans articulators and the Walker adjustable downward condyle path. It failed to take into consideration the variability of and the adjustments for the centers for the lateral movements embodied in the Walker instrument, and, in this respect, was not so good an articulator as the Walker instrument.

14. Christensen, Carl: A Rational Articulator, Ash's Quar. Circular, 1901; Problems of the Bite, Dent. Cosmos, 47:1184 (Oct.) 1905.

George G. Campion,[15] in speaking of the S or ogee form of the condyle path, recorded by him in the form of a succession of dots, says:

> This [the form and variation of the condyle path] shows at a glance how futile must be any efforts to construct an anatomical articulator on the lines of Bonwill, Walker, Christensen, and Gritman, and that no articulator can be in any real sense "anatomical" in which the condyle paths are not capable of being specially arranged and adjusted for each individual case.

To Mr. J. B. Parfitt,[16] of Reading, England, belongs the credit of being the first to construct an articulator which embodies this essential point.

15. Champion, G. G.: Some Graphic Records of Movements of the Mandible in Living Subject and Their Bearing on the Mechanism of Joint and Construction of Articulators, Dent. Cosmos, 47: (Jan.) 1905.

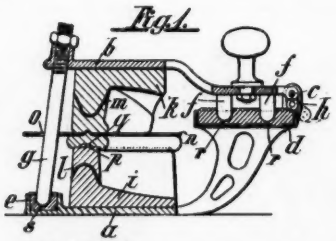
C. E. LUCE.

ARTICULATOR FOR MAKING ARTIFICIAL DENTURES.

APPLICATION FILED SEPT. 28, 1910.

1,009,912. **Patented Nov. 28, 1911.**

Fig. 1.



What I claim is:

1. In an articulator, the combination of an upper part, a lower part, disks adapted to receive plastic material and carried by one of said parts, and rounded pins carried by the other part and adapted to form impressions in the plastic material to provide a guide-path for the transference of the masticatory movement.

2. In an articulator, the combination of an upper part and a lower part, means provided on the lower part for receiving plastic material, and an adjustable guide pin carried on the upper part forming an impression in the plastic material.

In testimony whereof I affix my signature, in presence of two witnesses.

CHARLES E. LUCE.

Fig. 16.—Luce articulator.

16. Parfitt, J. B.: Articulator, Brit. Dent. J., 1908, p. 1.

From the foregoing, we see that Parfitt was the first to register and to imitate the curvature of the condyle path in an articulator. Imitating the individual curves in the articulator after Parfitt was for a time also advocated and employed by Gysi[17] (Fig. 17), but has since been abandoned by him with the introduction of the "trubyte" articulator.

Fig. 17.—Gysi adaptable articulator embodying curved condyle paths.

In 1907, Snow[4] introduced his articulator, the new century (Fig. 15), a two-dimensional gothic arch instrument.

This articulator, like the Bonwill and Christensen articulators, embodied only principles previously employed and noted in articulator construction, namely, copied the Gariot, Evans and Walker articulators. It failed, as did the Christensen articulator, to provide adjustments for the variability of the centers of the lateral movements embodied in the Walker articulator, and, in principle, was an absolute copy of the Christensen articulator. It was a well-built, usable and practical instrument.

Progress in the development of the articulator was manifestly lacking, in fact not up to standard, during the time

16. Parfitt, J. B.: New Anatomical Articulator, Odontol. Soc. Great Britain, 35, N. S. 1902-1903. (No view of the Parfitt articulator is shown in his article, which accounts for failure to illustrate this instrument.)

17. Gysi, Alfred: Problem of Articulation, Dent. Cosmos, 52:1 (Jan.) 1910; and Dentists' Supply Company's Advertising literature following.

intervening between the date of Walker's work and Luce's work, next to be discussed.

C. E. Luce,[18] of Stuttgart, Germany, who was given a patent in 1911 for an articulator, appears to be the first to claim patent rights to the improvement of an incisal pin support and guide (Fig. 16). The Luce articulator was in reality the first three-dimensional articulator, being the first to use a plastic material for recording and reproducing positional relations and movements of the mandible.

Luce was not given credit for embodying the three-dimensional principle in an

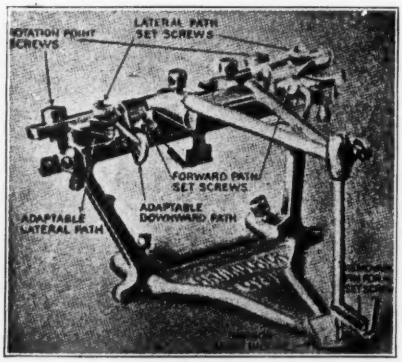


Fig. 18.—Gysi adaptable articulator.

articulator prior to Lentz, in my article "Full Denture Construction,[8]" because I thought it desirable to separate the metal, adjustable articulators from the plastic form of articulator. Furthermore, I do not consider that Luce necessarily appreciated the requirement for three-dimensional guidance or that he realized to its fullest extent just what he had accomplished. As the precise character and extent of the various mandibular movements are not readable with plastic negatives as they are with metal, graduated guides, use of this form of instrument does not show one the detail of the conditions with which he is working as does the metal instrument with its graduated dials. The plastic principle of recording and reproducing mandibular relations and movements will be discussed further in connection with the Homer articulator.

Gysi[17]: Now come the Gysi articulators (adaptable and simplex) (Figs. 17-19), two-dimensional gothic arch instruments.

The Gysi articulator of the date of

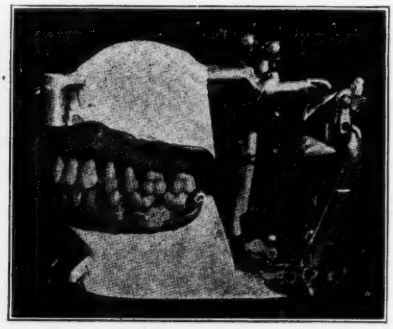


Fig. 19.—Gysi simplex articulator.

1910 (Fig. 17) copied the Walker and Parfitt articulators except for incisal guidance, the principle of the individual curved condyle slot plates belonging to Parfitt and the individual lateral rotation point adjustments and the adjustable condyle paths belonging to Walker. The incisal guide pin and guide, according to the Luce patent,[18] were invented and constructed by Luce. There is no record that I can find giving the origin of the incisor pin and guide dating back of the Luce patent other than description and application of it in Gysi's articles in the 1910 *Dental Cosmos,* according to which it be-

18. A "Dental Articulator Patent, U. S. A. No. 1,009,912," was granted to C. E. Luce, of Stuttgart, Germany, Nov. 28, 1911.

longs to Gysi. Gysi has a prior date in that his *Cosmos* article showing use of such a pin bore the date of January, 1910; whereas, Luce's patent application disclosing and claiming the incisal pin is dated Sept. 28, 1910, nine months later than the date of Gysi's disclosure. However, Gysi does not claim the pin in his patent.[19]

The introduction of the Gysi improved adaptable and simplex articulators (Figs. 18 and 19) followed closely the introduction of the original Gysi instrument (Fig. 17), in the *Dental Cosmos* in 1910.

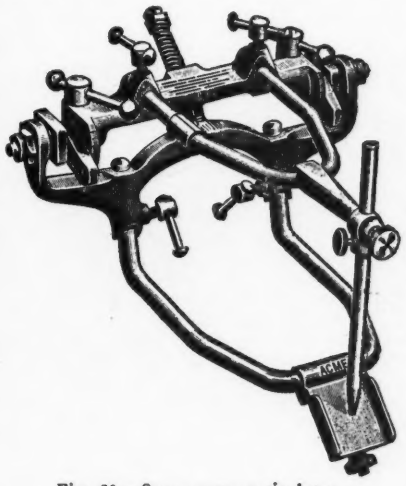


Fig. 20.—Snow acme articulator.

These articulators were the first to embody the Balkwill-Bennett movement. The rediscovery of the Balkwill movement by Bennett and incorporation of it in an articulator by Gysi was an important achievement in the study of mandibular movements and articulator construction. All investigators and builders of articulators since this time, except Monson and Wadsworth, have conceded the presence and importance of the Balkwill-Bennett movement and embodied it in their articulators.

Because of so claimed correctly located rotation points in the Gysi articulators, it was asserted that the bite could be changed in the adaptable and simplex articulators; that, because the axis of the opening movement was located back of and below the heads of the condyles, as shown in the Walker articulator, these articulators opened and closed as the mandible itself opened and closed. Use of and experience with these articulators proved this to be untrue.

We were much pleased to hear Dr. Gysi finally join in with us at the Minneapolis Meeting of the American Dental Association in 1928 with the statement that "Changing the bite is a chair operation and must not be trusted to the articulator." Please do not forget that I have stressed this fact ever since I have been identified with the subject of prosthesis. I have fought consistently for years for recognition and appreciation of this fact and for general adoption of the compensating technic advocated in my paper "Full Denture Construction." I have checkbit and remounted dentures in the articulator when grinding in occlusion as high as three and four times to compensate for the differences between the opening and closing axis of my articulator and the axis of nature occurring as a result of only the slight closure of the articulator brought about in grinding in the occlusion of dentures.

The S[illegible]acme articulator (Fig. 20) was the next to appear on the market. The improvements of this articulator over its predecessor consisted in the addition of the Balkwill-Bennett movement and adjustable two-dimesional incisal

19. A "Dental Articulator Patent, No. 1,041,270," was granted to A. Gysi, Oct. 15, 1912.

guidance. The Balkwill-Bennett movement in this articulator is effected arbitrarily and manually (not automatically) as in the Gysi and other articulators).

and Hall patents covering adjustable incisal guidance (Fig. 22).

This brings us up to a point in the development of the articulator in which an

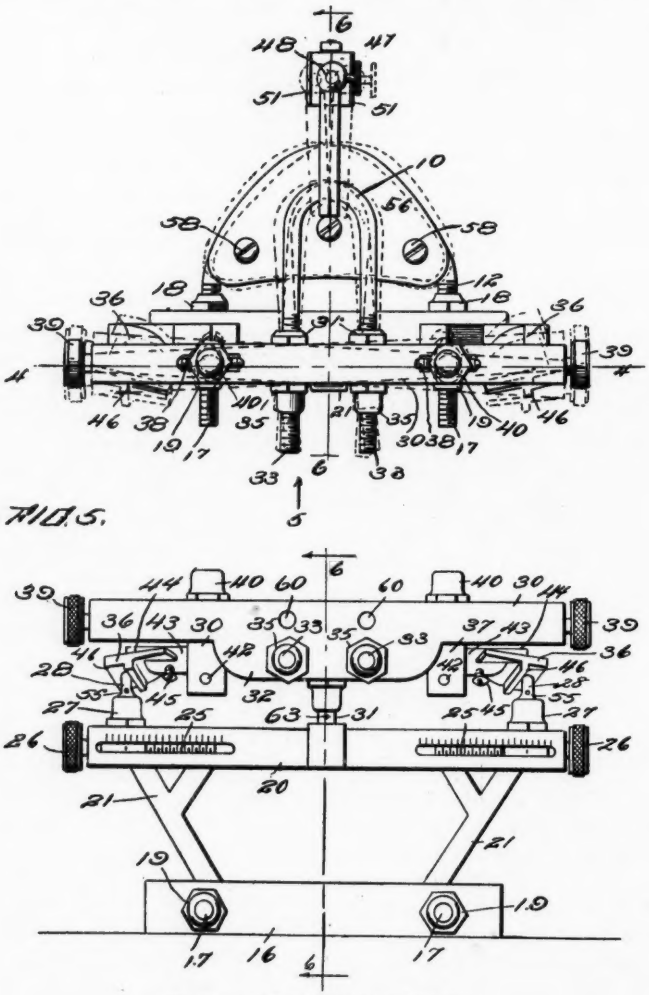


Fig. 21.—Hall adjustable articulator.

The adjustable incisal guidance feature in this instrument belongs to me, as shown by the respective filing dates of the Snow

entirely new, different and revolutionary conception of mandibular movements and articulator construction is introduced.

Hall[20]: Figure 21 shows the Hall adjustable articulator. This articulator represents my first endeavors in articulator building. Few, I presume, are aware of my having ever built adjustable articulators until recently in connection with the three-dimensional articulator, knowing and thinking of me as a builder and advocate of arbitrary articulators only, whereas, the fact is that I first built adjustable articulators.

The principles embodied in the construction of the Hall adjustable articulator were indicated and prompted by failure to get results with the Gysi adaptable articulator, so-called, as reported in my article (Fig. 71).[15]

The Hall adjustable articulator effected both gothic arch and arcuate lateral movement. This was, I believe, the first adjustable articulator to embody the principle of the arcuate movement. It embodied adjustable condyle guidance for both the downward and the lateral movements of the condyles, and copied to a great extent the principles of guide construction embodied in the Gysi adaptable articulator (Fig. 18).

The Hall adjustable articulator was also the first, to my knowledge, to embody the improvement of an adjustable incisal guide (Fig. 22) for reproducing the gothic arch movement of the incisor point with the incisal pin and guide.[20] The principles of this guide are now copied and embodied in the trubyte and Wadsworth articulators. The adjustable parts (Fig. 22, *51*) were conceived and designed for the especial purpose of directing the gothic arch movement of the incisor point as is now done, and in precisely the same manner, in the Gysi trubyte articulator.

According to statements made by Thor Arsted, of Norway, who visited this country recently, Gysi has now adopted and is using in his work in Switzerland an articulator (Fig. 23) (demonstrated by Arsted) that is an exact copy in principle of the Hall adjustable articulator shown in Figure 21, with the exception that he has fixed the mandibular lateral movement at 20 degrees, doing away with individual adjustment for this movement that he formerly advocated and used.

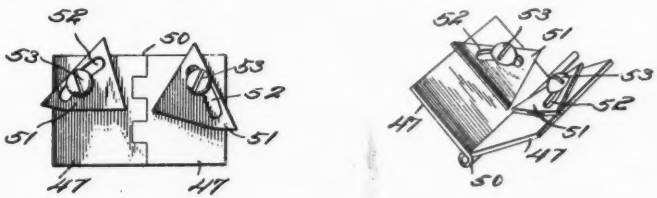


Fig. 22.—Hall three-dimensional incisal guide.

Hall[21]: Figure 24 shows the Hall arbitrary articulator. (For description of the theory of this articulator, see my previous article.[15])

The mistake in the development of the Hall arbitrary articulator was the adoption of a horizontal movement for the protrusive movement. This, as in Bonwill's articulator, was wrong. Had I adopted average downward or oblique movement instead of a horizontal move-

20. A "Dental Articulator Patent, U. S. A., No. 1,222,203," was granted to Rupert E. Hall, April 10, 1917.

ment, this instrument would have been fundamentally correct. This I did in 1924, and I showed the instrument (Fig. 25) at the meeting of the National Society of Denture Prosthetists and the American Dental Association in Dallas, Texas, the same year. This instrument is the finest, most complete and most nearly accurate arbitrary articulator ever built. It will check three-dimensional bites better than any arbitrary articulator in our analysis past and to be analyzed except the Luce, Lentz and Hall three-dimensional articulators. The typical lateral movement of the mandible (ideal normal, apparently) shows that the condyle on the balancing side moves forward, downward and inward and the condyle on the working side moves backward, upward and outward (Figs. 11 and 12 in previous article[8]). This typical movement is re-

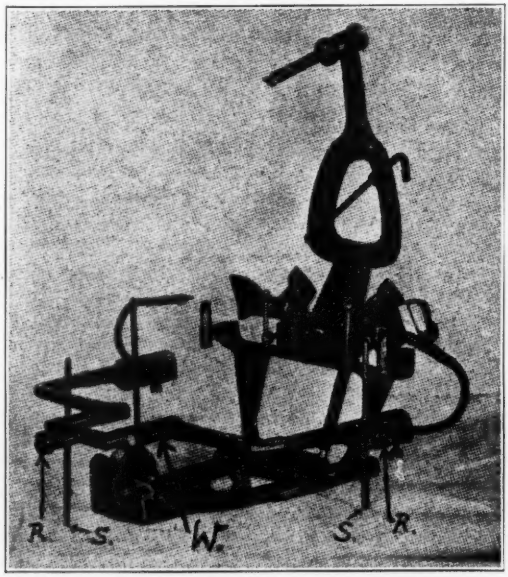


Fig. 23.—Gysi adaptable articulator (modified) as used by Gysi in his teaching in Switzerland.

lator ever built with which I am familiar and better than any two-dimensional adjustable articulator the movements of which are based upon and are limited to the gothic arch two-dimensional character of movement; and, for this reason, use of such an instrument in indicated in preference to the use of adjustable articulators so constructed and limited in their movements, which includes every produced with the Hall arbitrary articulators.

Figure 26 is a diagrammatic demonstration of how the Hall arbitrary articulators reproduce, automatically, either gothic arch or arcuate movement of the mandible and central and so-called right

21. A "Dental Articulator Patent, No. 1,271,161," was granted to Rupert E. Hall, July 2, 1918.

and left lateral rotation axes. That these articulators are universal in this respect has not been understood and appreciated. I say this because practically every one seems to have interpreted them as being articulators restricted to and capable of making arcuate lateral movement from a single central axis only. This form of construction, to the contrary, is unlimited; whereas, the gothic arch two-dimensional principle of construction is limited to the gothic arch or right and left axis character of movement.

I carried the illustration shown in Figure 26 all over the country for years, and I am not sure that any one ever understood what I was trying to demonstrate. However, I again present it for consideration. It was correct and of value in those days and is so today.

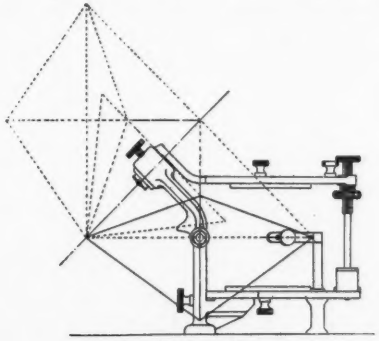


Fig. 24.—Hall articulator.

It was with the use of the demonstration shown in Figure 26, and with other equipment, that I formerly undertook to demonstrate the automatic feature of the Hall articulator. Any degree or form of gothic arch, including arcuate movement, can be made, and universal grinding of the teeth with its universal movements automatically provides ground in occlusion for any form of gothic arch movement the individual jaw might require. The name "automatic" in this connection is not nearly so bad as it has been held to be by some. Dr. Gysi, on his latest appearance in America, stated that he now regarded reproduction of the individual gothic arch in the articulator as the most important consideration in reproducing mandibular movements. With regard to this specification, the Hall automatic anatomic articulators can qualify 100 per cent and get better as time goes on, according to Gysi's latest specification. In grinding in the occlusion of dentures in all directions between the protrusive and the extreme lateral (arcuate) movement of the articulator, accommodation for individual gothic arch (incisive or prehensile) movements are automatically provided.

The central axis principle in articulator construction, shown in the Hall arbitrary articulators, consists of mechanical means whereby a straight forward (prehensile or incisive) movement about a horizontal axis (Fig. 26, *A*) may be made independently of or in combination with the lateral movement, and a lateral movement (Fig. 26, *B*) about a central oblique axis may be made independently of or in combination with the protrusive movement. So it is obvious that such an articulator can reproduce any possible prehensile (gothic arch) movement of the incisor point between the straight forward (incisive) movement and the arcuate lateral (masticatory) movement (Fig. 26, *C*). Thus, it is shown that this type of articulator does all and more than the gothic arch type of articulator does or can do (Fig. 26, *D*).

This illustration also demonstrates how the condyles describe unequal forward and backward movement, effecting so-called right and left lateral rotation axes thereabouts in lateral movements (Fig. 26, *E*), while the incisor point de-

scribes a gothic arch movement. The axis of the opening and closing movement, being located below the heads of the condyles, offsets or modifies the backward and upward movement of the condyle on the working side, making upward and backward movement of the working condyle unequal to or less than that of the forward and downward movement of the balancing condyle.

To show how even Dr. Gysi failed to understand and appreciate the principles embodied in the Hall arbitrary articulator and how severely he ridiculed my idea of the arcuate movement of the mandible, I quote from his article (translation) from the *Schweizerische Vierteljahrsschrift für Zahnheilkunde* (volume 29, 1919, page 90).

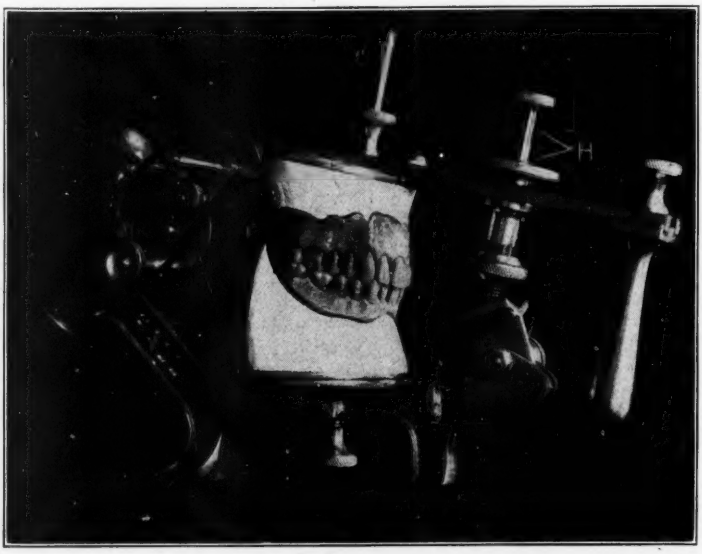


Fig. 25.—Hall arbitrary articulator.

HALL'S AUTOMATIC ANATOMIC ARTICULATOR

BY A. GYSI

This articulator was put on the market by the S. S. White Dental Manufacturing Company. They had manufactured no other laterally movable articulator (beside the Bonwill) since Bonwill's time, that is, about 40 years ago.

Since Bonwill, a large number of scientists have enlarged Bonwill's idea, perfecting it in such a way that, beside the forward thrust of the condyles, they have provided for a sloping downward and inward movement.

It was believed that finally the real motion of the human lower jaw was known, since the most prominent scientists had arrived at unanimous results, that is to say, since Luce, of Boston, had investigated this motion purely anatomically, and since Walker, of Pass Christian, (through mechanical projection), Breuer, of Vienna (through cinematographic projection), Bennett, of London (through optical projection), and I myself (through graphic projection) had found the direction of motions of the condyles during the masticating process. These results were also reexamined and confirmed by many others.

However, it is an old established truth that one may have a different opinion about everything. For instance, on the basis of purely historical facts, the real existence of Christ has been disputed, and our national hero, William Tell is said not to have lived at all,

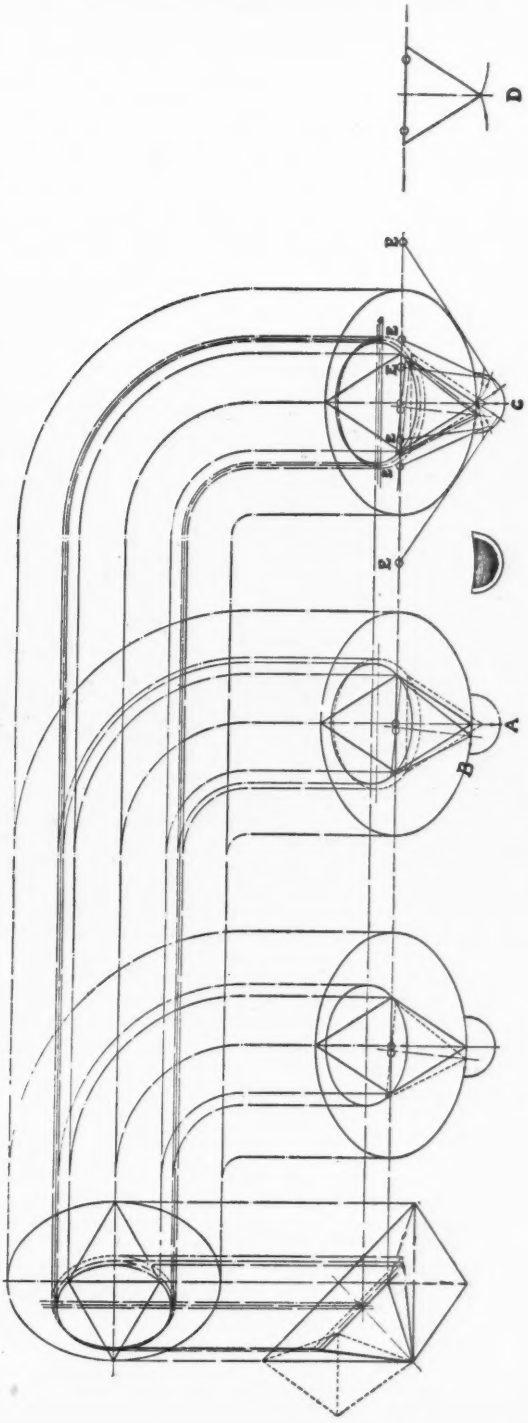


Fig. 26.—Diagrammatic illustration of the movements of the Hall arbitrary articulator.

and even in relatively recent days, all reasons have been compiled for the purpose of proving that the great Napoleon I never lived.

Even today there are plenty of people, with an academic education even, who do not believe that the moon revolves around the earth and both revolve together around the sun. It is true that it requires a certain amount of intelligence, which should enable us to absorb such ideas so thoroughly as to be convinced of them.

Along comes now an American dentist, Dr. Rupert Hall, and teaches that the motions of the lower jaw do not emanate from a left and right axis, but around an axis located in the center plane of the head, running from the neighborhood of the base of the nose (glabella) to the occipital protuberance. Hall reports how he tried to make an artificial denture for his father in the various articulators, even in mine, but that all of them failed to function properly, and when searching for the shortcomings of these articulators, he finally arrived at his invention.

Fig. 27.—Gysi registration.

It is true, though, that the motions of the human jaws are very complicated and that no standard formula can be applied which, in all cases, would define the motions, for the simple reason that man is the most differentiated being on earth.

Lower animals of one kind (for instance, the June bug) are almost identical. However, with higher animals, the variations within one species are becoming more pronounced, and, in human beings, the differentiation has reached such a degree that each individual forms a species by itself. For instance, each human being has not only his own thinking power, but has also a physiognomy of his own, his own distinct voice, his own individual walk, his own handwriting, and, as the specialists in the articulator problem have found, also his own movements of the jaw. Thus it is very probable that Hall's father has the movement of the jaw described above.

Among the large number of mandibular movements registered by myself, I had two in patients whose axis for the lateral jaw motions were practically located in the median line or at least very close to it. For instance, Dr. J. L. Williams from London came to me with a woman patient who was said to have great difficulty in obtaining a well functioning denture. When registering her mandibular motions, it was found that the center of the motion lay exactly in the sagittal plane, which compelled me to make a special change in my articulator used at that time, and one adapted to this case. The dentures made in this way worked then, indeed, to full satisfaction. But this success could not induce me to bring an articulator on the market which would show this very motion only, as Dr. Hall did.

At the Dental Institute of Zurich, I had occasion to watch a similar case, in which the right and the left center of rotation were only 6 mm. distant from the median line; in other words, where they were almost identical. From my observations, such cases are very rare, and, for this reason, Hall's articulator is by no means a really normal anatomic articulator. It is far from my intention to claim that my articulator represents the final word in the construction of articulators, and it is more than likely that other mechanical solutions of the problem of articulation will be found which may be even better. Up to the present, however, my articulator represents the results of the investigations of the best known and most successful authorities in this line. If, therefore, a new articulator is offered to the dental profession, it may properly be expected that its construction should be based on scientifically exact investigations that represent the result of a large number of carefully recorded cases. These proofs have not been furnished by Dr. Hall. As far as I

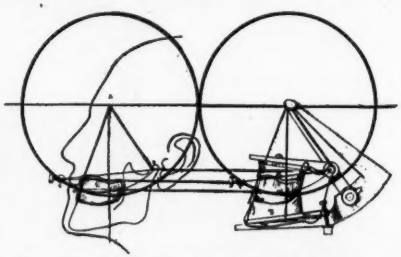


Fig. 28.—Monson's theory and articulator.

am familiar with the literature on Hall's articulator, Dr. Hall has only published comparative studies on mammal skulls, on which he is believed to have found a similar location of the center of rotation. This is insufficient for our dental profession: we must insist on experiments on the human being, or, better, on the living human being. And if an adherent of Hall's theory, as, for instance, B. W. M. Randall (*Dental Cosmos*, February, 1919, page 183), claims that up to the time of Hall all other previous inventors of articulators have "looked through the wrong end of the telescope" and that "the mystifying facial arc and the search for the plane of the condyles started research at the wrong end,"

The Wadsworth Universal Articulator

[Patented]

Fig. 1

THE outstanding features of the Wadsworth Universal Articulator are, ADJUSTABLE CONDYLES—INTER-CONDYLAR WIDTH ADJUSTMENT—ADJUSTABLE INCISAL GUIDE PLANES—RADIAL CENTERING PLATE.

This instrument with its attachments permits accurate reproduction of condylar and mandibular movements in any and every case, whether full or partial restoration is required, or whether the treatment extends into the field of orthodontia or periodontia.

A complete booklet has been prepared, fully describing and illustrating the articulator and its universal adaptability.

Those interested may have a copy on request.

[3]

Fig. 29.—Page from Wadsworth booklet.

such phrases are not proofs, unless they are based on exact experiments or practical experience. In using but phrases, one throws dust into the eyes of those who are forced to believe in the experience of others. And if in the editorial department of the same issue of *Dental Cosmos,* page 175, the editor writes: "The technical system of Dr. Hall is, in our opinion, the most appealing and interesting demonstration of the manufacture of plates which was ever taught for the students of dentistry," this shows, in my eyes, no sign of great literary and practical knowledge in this line. I can easily understand that Hall's articulator will find many adherents, as it is produced by the S. S. White Dental Manufacturing Company, which, it is conceded, has a world reputation for new and practical instruments of first class quality. In the present case the initials S. S. W. have the same effect

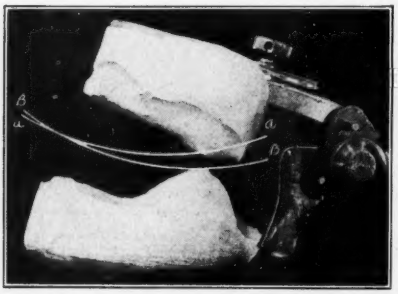


Fig. 30.—*AA,* Monson and Wadsworth curve, which is not possible of execution and therefore is not basic. *BB,* practical curve.

on many as the burning candle has on moths, which scorch their wings.

I made the proofs of Hall's articulator in the following manner:

First test: From my collections, the two most nearly perfect models of natural dentures were fastened in this articulator. Both models have well developed abrasion facets on the teeth, from which it can exactly be seen in what directions the mandibular motions must have taken place.

Duplicates of these two models were also fastened in my own simplex articulator.

When making lateral mandibular movements, the following surprising results were observed: In the Hall articulator, both rows of teeth became separated at the slightest lateral movement, the incisors especially losing all contact.

On the other hand, in my simplex articulator, the teeth would slide exactly along their abrasion facets. Molars and incisors remained in articulating contact during all lateral movements.

After the incisor guide on Hall's articulator was removed, the teeth maintained better contact in lateral relation, but the molars, bicuspids and cuspids assumed cusp to cusp relation instead of gliding through the spaces between their antagonists.

Second test: On the lower arm of Hall's articulator, two condyle points were fixed in the correct position of Bonwill's triangle by means of wires, and, on the upper arm, likewise with wires, the joint sockets were marked.

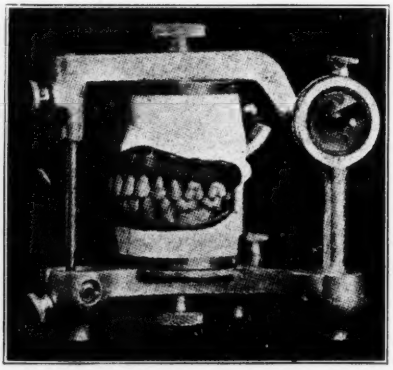


Fig. 31.—Hanau articulator.

During lateral movements, without the aid of the incisor guide, it was shown that both condyle points performed equally extended movements, only in opposite directions; which normally contradicts all investigations made up to now. In the presence of incisor guidance, the one condyle point moved forward (in the same way as Bonwill has stated), while the other condyle points performed a steep upward motion, which cannot occur in nature, as the condyle rests at the bottom of the joint socket and cannot go higher.

Third test: On the tooth row of the lower arm in Hall's articulator, I placed a wax plate as a masticating plane or occlusal plane, and, on the upper second molars, resilient

graphite points were fastened. When making lateral movements, these indicator points marked short stretches of arcs on the wax plate, which complemented each other to ONE uniform circle around the centrically located articulator axis. If the same experiment is made in the mouth of a patient (having either natural or artificial teeth), the resilient indicator points will mark one angle each, both of whose arms are part of TWO circles, that is to say, around the right and left motion centers.

This is ample proof that Hall's articulator has not the proper lateral movements in a horizontal direction.

The same experiment, made in my simplex articulator, furnishes the natural angle designs.

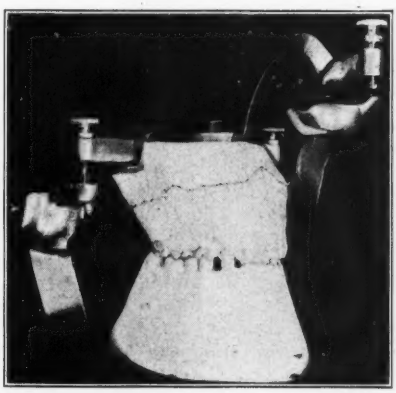


Fig. 32.—Needles split cast method of testing the adaptability of articulators (see also Figures 33-34).

Fourth test: On the plaster model in Hall's articulator, I placed a thick layer of soft wax on the second lower molar, and on the occluding molar of the upper plaster model I fastene ', in a vertical position, a piece of tin plate, about 1 cm. square, in the direction of the teeth row. When making lateral movements, this tin plate cut a groove into the wax corresponding to the longitudinal groove in the occlusal surface of the lower molars. The angle of this groove did not exceed 82 degrees. Such an angle Hall now grinds into the occlusal surfaces of the molars, according to his instructions and according to information by letter from America. What such an angle means can be seen from the following: In 1911, I took measurements of teeth in the famous collection of skulls of the London Museum of Surgeons, and found as the steepest longitudinal groove of the molars, an angle of 104 degrees and an average angle of 120 degrees, while flatter masticating planes showed but 134 degrees. Practical experience with complete dentures has generally shown that, for stabilizing the artificial teeth, an average groove angle of 120 degrees is the best. Many dentists do not even wish to apply an angle at all, making the occlusal surfaces of the teeth entirely flat, that is to say 180 degrees.

I do not wish to enlarge on this subject, since I presume that the S. S. White Dental Manufacturing Company will soon bring on the market molars of 82 degrees, and then every one will be able to pass his own judgment on them, and each will hear his patient's judgment.

This fourth test proves again the fact that nothing is too stupid as not to find its adherents.

Fifth test: I am also able to prove that the opening axis in Hall's articulator is wrongly located, and so is the axis for the forward thrust; however, this would lead me too far into anatomic and geometric facts to be understood by the admirers of Hall's system.

One very simple experiment I wish to describe here, by means of which the busy dentist who has not time to check extensive investigations into the principles of the articulator will have a chance to quickly form his own judgment as to which articulator comes nearest the truth.

Take a square piece of soft tin plate, about 2.5 cm. long and about 0.5 mm. thick and bend it in such a way over your incisors (natural or artificial) that one half of the plate will extend on the labial side and the other half on the lingual side. Fill this improvised partial impression tray with Stent's or Kerr's impression compound and take an impression of the incisors. This should be done on the upper and lower jaws. Then fasten on the lingual side of the lower tin plate (with sticky wax) a piece of pencil graphite in such a way that it will extend so far beyond the lower impression as to touch the lingual side of the upper tin plate.

Now replace both impressions in the mouth and make masticating movements, first forward and backward as far as possible, and

then from the backward position to left and right. Then remove the upper impression from the mouth and look at the lines marked thereon. If the pencil line of the lateral movements forms an arc running horizontally over the metal plane, Dr. Hall is right. However, if the pencil line forms a gable-like angle, my simplex articulator is the right one, because when it is used for the same experiment, such an angle-like design is formed.

If a large number of dentists will send me the result obtained by this experiment, I am willing to publish statistics thereon, certified by a notary public, because I am not afraid of the result.

Conclusion: All of these experiments furnish the proof that Hall's articulator is NOT AN ANATOMIC ARTICULATOR. Nevertheless, it must be feared that this instrument will become one of the many illusions which have swamped our profession at intervals, such as, for instance, the principle of the exclusive use of guttapercha as filling material, Arthur's grinding method of the proximal surfaces of the teeth, the systematic extraction of the first permanent molars, the cataphoresis, the analgesia and others. However, at a time when Bolshevism finds so many adherents, it is quite possible that Hall's articulator, too, will find a goodly number of adherents.

Dr. Hall claims that the theory of the condyles path, such as it is known today, is an error, and practice based thereon is, therefore, a mistake. He also says: "The condyles are but a part of the masticating apparatus, comparable with that part of a wagon which must have a road for its movements during a ride, on which it is supported and on which it moves. However, the occlusal planes of the teeth represent the road, not the condyles path."

Dr. Wilson, too, says: "The teeth guide the jaw motions and not the condyles (*Dental Summary,* March, 1916, pages 220 and 221). Hall says also (page 221): "The condyle plane is, in reality, not a certain plane, but a multitude of crooked and snakelike (winding) lines running into each other."

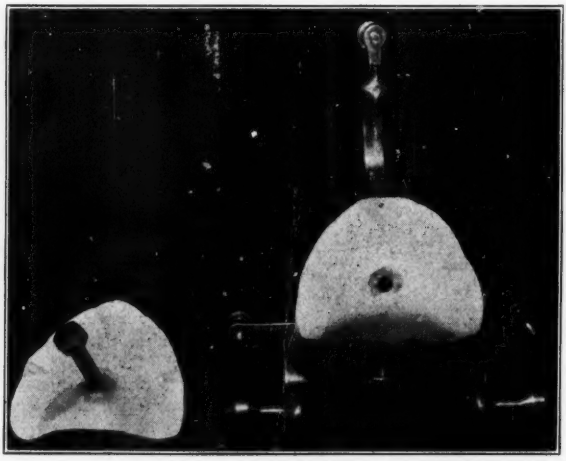


Fig. 33.—Needles split cast method of testing the adaptability of articulators.

Such designs I have also observed with my own recording apparatus, but only if operated by beginners who have not had the necessary practice to hold the recording instruments fast to the patient's head, or if the patient, instead of making correct jaw motions, moves the entire head.

If the condyle did not take part at all in guiding the lower jaw, it would be impossible to obtain a distinctly defined record of the condyle plane. However, if measurements are taken several times in succession on a

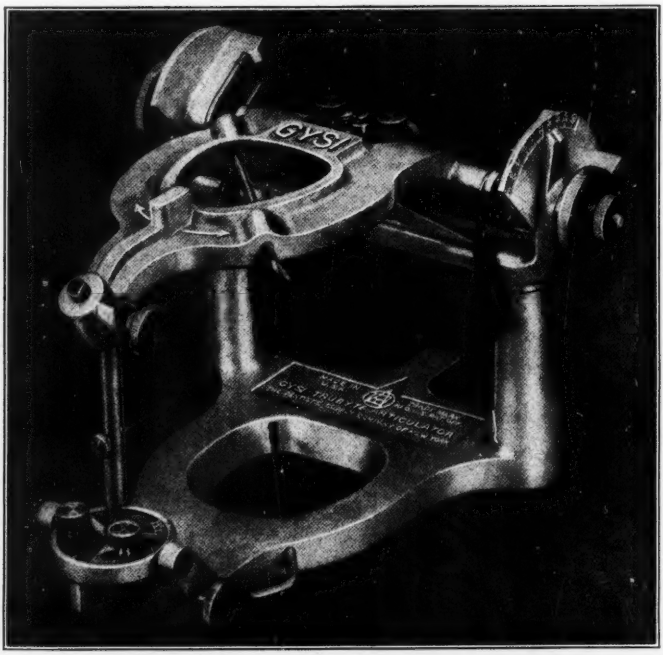
toothless patient, on different days, as regards the condyle plane, one will always obtain the same condyle plane characteristic of this patient, provided one is an expert in this work. Naturally, both tubercula articularia do not form the entire "road" on which the lower jaw will "travel," because the lower jaw is, so to speak, a three-wheeled vehicle. For this reason, I provided my articulator with the incisor guide, on which the front supporting pin moves. By this device, the molars are led into their proper path between both condyle guides and the incisor guide, whose work is done, in nature, by the lingual surfaces of the upper incisors, along which the cutting edges of the lower incisors move during mastication. In addition, the articulating facets of the other teeth partake in this guidance, but only in harmony and under the guidance of the condyle plane. If there is any disharmony between the articulating facets and the condyle plane, the patient will not be able to make any well functioning lateral movements, and consequently will make only vertical movements. If, indeed, the entire movement of the jaws is accomplished exclusively by the teeth, why did Hall find it necessary to supply his articulator also with an incisor guide with a supporting pin sliding on it? The truth is that he has merely copied the principle of these guides from me without giving any explanation for the monstrous form which he gave to this guide. FURTHERMORE, HALL HAS ALSO COPIED THE ANATOMIC METHOD OF POSITIONING OF THE TEETH RECOMMENDED BY ME, WITHOUT, HOWEVER, MENTIONING MY NAME. He merely changed the name of the method by saying "kicking the teeth in place," and the word "automatic" he applies to his articulator, in order to make the dentists believe that it will only be necessary to set the articulator in motion, whereupon it will automatically "kick" the teeth in place. Very probably, Dr. Hall will succeed in improving on his "automatic" articulator to such an extent that one need but insert a coin in it, and it will place the teeth in proper position, just like an automat. It is to be hoped that Barnum will carry with him on his next journey, such an automat, which will at once vulcanize the teeth and deliver them ready made to the patient.

Fig. 34.—Needles split cast method of testing the adaptability of articulators.

In scientific literature, it is usual to cite the names of authors whose intellectual property one uses in any shape or form, as one will otherwise run the risk of being marked as a plagiarist. And since Dr. Hall does not give due credit to any author in copying him, he puts himself outside scientific usage and custom. He cannot use the excuse that he has had no knowledge of my writings because they are more widely distributed in America than in Europe.

I cannot assume that, in forgetting to comply with this custom, he is justified by patriotic reasons, and therefore, I must presume that either he or the S. S. White Dental Manufac-

THE GYSI TRUBYTE ARTICULATOR



Grand Prize Winner

Sesquicentennial International Exposition

THE masterpiece of the world's acknowledged authority on articulation—Dr. Alfred Gysi, already author of five articulators, each the recognized leader of its time.

THE Gysi Trubyte Articulator is applicable to any technic from the plain line to the most exacting scientific procedure. Reproduces all known masticating movements of the human mandible.

Ask us for descriptive literature or let your dealer show you the Gysi Trubyte Articulator

THE DENTISTS' SUPPLY COMPANY OF NEW YORK
220 West 42nd Street, New York

THE GYSI TRUBYTE ARTICULATOR

Fig. 35.—Advertisement of the Gysi trubyte articulator, "Grand Prize Winner."

turing Company has been prompted by financial considerations. Therefore, his articulator is not a scientific anatomic articulator, but a financial articulator.

I now want to close, since I would have to write a whole book if I had the desire to argue in a purely scientific way against all other opinions and statements of Dr. Hall and his adherents. After all, all my arguments would be useless for Hall's adherents, as long as they refuse to make, in their own mouths, my "fifth test" described above.

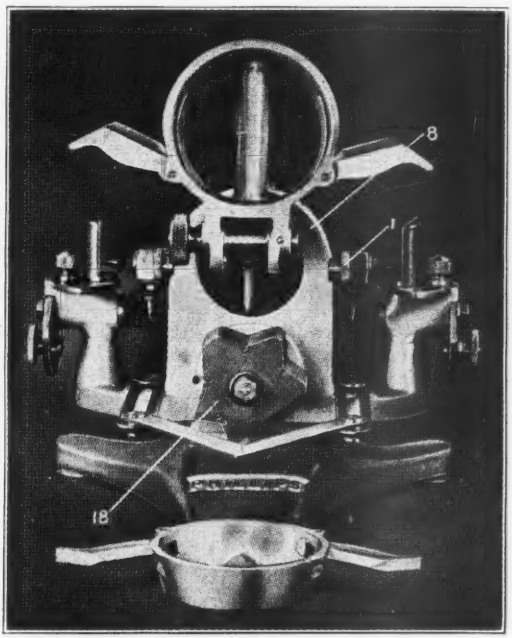


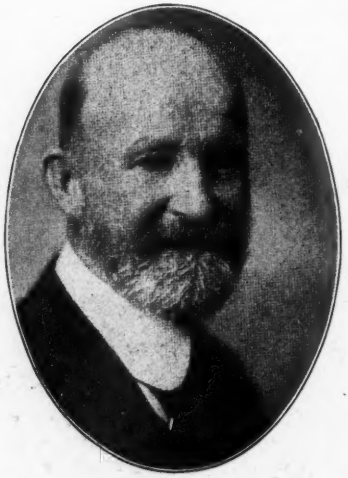
Fig. 36.—Phillips articulator.

In a great many recent articulators, parts of my articulator have been copied, and I said nothing against it, because of the fact that this had been, more or less, done in a decent and fair way and because these articulators in question were more or less usable instruments. In Dr. Hall's case, I deemed it necessary to warn my colleagues.

In all moderation, I think I may claim that Dr. Gysi has done himself little credit in writing this article. A careful study of the subject will show that he is as far wrong in some of his criticisms and opinions as he is intemperate and unreasonable in his attitude regarding my articulator and my opinions.

Since learning something about my articulator, Gysi has made extensive and important modifications in the statements contained in this article.

Gysi's "fifth test," which he is so insistent on, is answered in one of my previous articles,[11] Figures 85, 86 and 87. However, I will add that his method (Fig. 27[11]) of making this test is of no importance in the controversy because he disposes the graph plate and stylus at an angle to the horizontal plane, in place of parallel and perpendicular to it, as he does in edentulous cases.



Dr. Gysi Writes

"LAST WEEK I received with great pleasure the latest Trubyte Articulators. I am quite astonished at the precision with which they are made—they are really wonderful. I never thought that in quantity production such a degree of accuracy could be reached. ***I am fully satisfied with them.***"

AND YOU, Doctor, will be astonished at the accuracy with which the **Gysi Trubyte Articulator** reproduces the masticating movements of the human mandible.

Use any preparatory technic you prefer—and when you come to the actual articulation, put the case on your Gysi Trubyte and note the finer results.

To a skillful technician this instrument will open new possibilities in adaptable articulation. To one of average ability it will prove a genuine aid toward better workmanship.

Your dealer sells the Gysi Trubyte Articulator

THE DENTISTS' SUPPLY COMPANY OF NEW YORK
220 West 42nd Street **New York, N. Y.**

AWARDED GRAND PRIZE AT THE SESQUICENTENNIAL EXPOSITION, PHILA., 1926

Fig. 37.—Page advertisement of Gysi articulator.

The following incident will, I believe, be as amusing to the reader as it was to me.

When Dr. Gysi was in Chicago recently, I asked him to be my guest for lunch, together with some of our mutual friends, and to visit with us in my office in the afternoon, and he replied that he would if it was agreeable with Dr. Clapp. Whereupon, I asked Dr. Clapp for his consent and received the following reply: "All right, but don't do as Dayton Campbell did in Kansas City. Campbell talked and demonstrated dentures all afternoon to him, and you know that's no entertainment for Gysi." I answered, "I will not discuss the subject with him."

With Stansbery's three-dimensional checkbite and my three-dimensional articulator, I can show Gysi, and also Clapp, mandibular relations and movements unknown to and unobserved by them, if they are sufficiently open minded to recognize a fact when it is proved to them.

For example, in Gysi's proposed Test 2, he states that the condyle cannot move upward on the working side, "owing to the fact that the condyle point rests on the bottom of the joint socket and cannot go higher." To show that Gysi is very much mistaken in this statement, I cite Figures 38 and 39 and other like proof presented in one of my previous

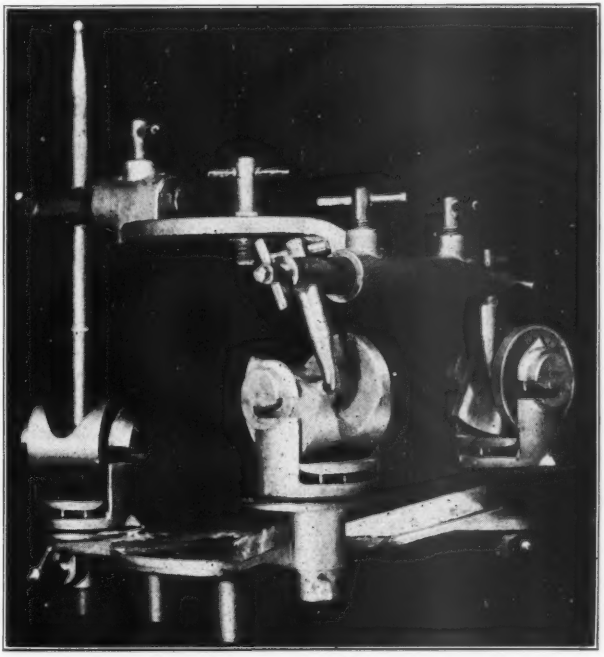


Fig. 38.—Hall three-dimensional articulator, showing adjustments for extreme mandibular relations and movements heretofore not discovered and reproduced in articulators.

articles[8] that covers the point in question.

Others besides Gysi have ridiculed my work. The statement that "the design of several articulators has been based upon some purely theoretical or preconceived conception of the kinematics of the dental mechanism" and similar statements and remarks have been made by members of the profession.

Who of the readers of this paper and students of prosthesis observing and understanding the demonstrations given in my recent articles[1] now believes that the accurate lateral movement of the mandible embodied in the Hall articulator was based upon "purely theoretical and preconceived conception"? I performed the experiment reported in my article published in the September JOURNAL in connection with Figure 71, in 1914, and I followed it with repeated demonstrations of the same thing over and over again before the profession throughout the entire country, and yet, fifteen years later, I am to be found still trying to make this same fundamental fact plain to the profession. I felt in those days that I had an insight into and an explanation for the lateral movement of the mandible not understood or appreciated, and today, by way of Stansbery's double gothic arch tracing, the Hall three dimensional articulator and the demonstrations shown in Figures 85, 86 and 87,[11] I am able to demonstrate and to present the fact in a positively convincing, scientific and practical manner. However, I presume we will have, or rather continue to have among us, individuals, manufacturers and even factions that will combat or try to combat the truth of the findings and demonstrations presented.

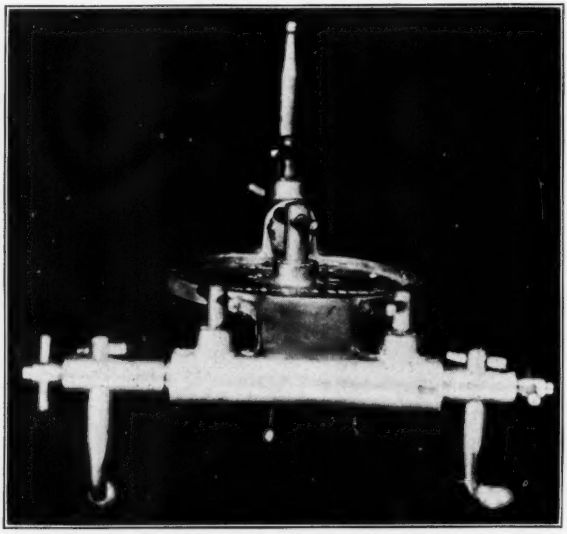


Fig. 39.—Hall three-dimensional articulator adjustments.

That it will be nothing short of a shock to many to have to face the fact that the normal movement of the incisor point is arcuate rather than gothic arch

in character is certain. For, as previously stated, the gothic arch two-dimensional movement of the mandible has been the basis of and has dominated all activity both mental and manual in studying the movements of the mandible and building articulators, except in the case of Frank, Schweitzer and Hall, ever since the movements of the mandible have been studied and articulators have been built.

Once this movement is understood and appreciated, it is going to spell good-bye to all articulators not capable of reproducing it, which, according to my analysis, includes just about all of them. Many of these articulators are favorites of long standing; and fortunes have been spent in their development and sale and time untold has been wasted by the profession in their use.

In 1916, Monson[22] introduced a so-called spherical articulator embodying means for using dividers for projecting arcs (surfaces) of a single sphere in order to arrange the teeth in conformity therewith, to which character of surface their arrangement was conceived and believed to be demonstrated to conform by Christensen, when the condyle paths of the two sides are the same (Fig. 28).

The Monson instrument is an arbitrary articulator and copied the Hall central axis principle of lateral movement and embodied an improvement of registering downward movement in the protrusive movement not in the Hall instrument at that time, but which was added in the later model (Fig. 25).

Monson refuses to concede the presence of the Balkwill-Bennett movement and his articulator fails to reproduce this movement; this, too, in the face of the fact that Monson himself demonstrated this movement with specially devised equipment and tests before the National Society of Denture Prosthetists at the Boston meeting in 1920. It was not quite sportsmanlike for Monson to refute his confirmatory demonstration of this movement on that occasion. His contention at the time was that his tests showed the movement to be in the reverse direction to that claimed, i.e., the condyles shifted to the left when the mandible moved to the right, and vice versa. Monson erred in his interpretation of his demonstration because he moved the cast of the upper jaw and interpreted its movement to represent movement of the lower jaw, which, of course, is the reverse of that of the lower. And when I called his attention to his misinterpretation and showed him that his test definitely proved the presence of the movement, he refuted his demonstrations and has ever since fought the idea of the Balkwill-Bennett movement.

The movements of the Monson articulator are not spherical, as described and claimed by Monson, because the theory of its movements does not take into consideration the modifying influence of the opening and closing movement occasioned by the cusps and overbite of the teeth. When it is used with inverted cusp (cuspless) teeth, eliminating the opening movement, its movements become spherical.

If Monson would discard his theory in connection with the movements of his articulator as I did, and feature the practical points of his articulator, he would be more consistent and would command greater appreciation for his articulator, because, outside his failure to recognize and embody the Balkwill-Bennett movement in his articulator, he has a good instrument.

22. Washburn, H. B.: History and Evolution of Study of Occlusion, Dent. Cosmos, 67:333 (April) 1925. (Monson advises that the best description of his articulator is to be found in Washburn's article.)

Wadsworth[23] adopted Monson's dividers for use in establishing centers for projecting arcs (surfaces) of spheres with variable centers and radii according to the measurements of the individual Bonwill triangle after Morton[24] for adjusting the centers and condyle paths of his articulator in order to arrange the teeth in conformity therewith, to which character of surfaces their arrangement was conceived and believed to be demonstrated to conform by Christensen, when the condyle paths of the two sides are different (Fig. 29). Like the Monson articulator, the Wadsworth instrument takes no cognizance of the Balkwill-Bennett movement.

The following excerpts are taken from the introductory pages to the Wadsworth articulator booklet describing and expounding the virtues of this instrument.

The Wadsworth Universal Articulator, unlike other articulators, is designed for universal use in dentistry.

In prosthodontia for partial as well as full dentures.

In Crown and Bridge Work for fixed, removable, and movable-removable restorations.

In Periodontia for correcting traumatic occlusion.

In Orthodontia for survey of cases.

In Diagnosis and Research for any of these cases.

MECHANICAL REPRODUCTION OF MASTICATORY MOVEMENTS.

Inasmuch as the temporo-mandibular joint is so simply constructed and the movements of the condyles definitely determined by the formation of the articulator surfaces of the temporal bone and definitely limited in their range by the investing tissues, ligaments and muscles, it appears to be a simple matter to closely reproduce these in a mechanical appliance.

CONDYLAR AND MANDIBULAR MOVEMENTS.

These movements are simple and easily understood from an analysis of the writings of anatomical authorities.

One of the valuable features of the Wadsworth instrument is that it embodies a means by which we are able to definitely determine the character, trend and position of the curve upon which the teeth must occlude and articulate in order to secure stability of the dentures, a feature not heretofore embodied in any articulating mechanism.

Establishing this curve, prior to the development of the Wadsworth Articulator, has always been dependent upon the ability, experience and judgment of each individual operator; and there have been very few who have been wholly successful.

The versatility and perfection of this instrument is proclaimed in no uncertain terms.

The Wadsworth articulator is a two-dimensional gothic arch type articulator and cannot, therefore, reproduce arcuate movement of the mandible and accurately check three-dimensional bites.

The principles embodied in the design of this instrument and which belong to others are:

1. The adjustable condylar guidance is a copy of that typically employed in and characterizing many articulators. This principle belongs to Walker and not to Wadsworth.

2. The intercondylar width adjustment belongs to J. B. Davis and H. Leuchsenring, of Philadelphia.

3. The incisal guide pin and guide belong to Luce or Gysi.

4. The design of the adjustable incisal guide (adjustable lateral leaves in the form of a hinge) belongs to me[20] (patent applied for in 1914 and granted in 1917).

5. The use of the divider for determining the so-called basic curve or curves belongs to Monson.

6. The disk on the top of the articulator for locating the center for project-

23. Wadsworth, Frank: S. S. White Wadsworth Articulator Booklet.

24. Morton, J.: Articulators; a Criticism of Dr. Frank's Investigations and Experiences, Brit. Dent. J., 29 (Oct.) 1908.

ing the basic curve, according to the measurement of the right and left sides of the triangle, after Morton, belongs to Wadsworth, though I have heard that it was suggested to Wadsworth by Dr. Needles.

So the addition of Davis' and Leuchsenring's intercondylar adjustment to Walker's adjustable condylar guidance and Monson's dividers, with Luce's, Gysi's and my incisal guidance added to these, ornamented with the Wadsworth (Needles?) disk, makes a Wadsworth articulator.

We will now analyze the claims for this instrument, together with some of the statements made in connection therewith, and see how near it comes to fulfilling them.

"The Wadsworth Articulator is unlike other articulators, in that it is designed for universal use."

This statement is as superfluous and as nonsensical as it would be to say that a washing machine will wash handkerchiefs as well as shirts.

An articulator meeting the requirements of one need, in the sense being discussed, would of necessity meet the requirements of all other needs of an articulator.

"The temporomandibular joint is a simple joint" and "it appears to be a simple matter to closely reproduce the movements of the mandible."

This is the first time that I have ever known of the statement being made that the temporomandibular joint is a *simple* joint. The temporomandibular joint is the most complicated joint that could be imagined. In fact, it is not a joint at all in the sense of a hinge or a ball and socket. The momentary centers of the movements of the condyles have been known for years to be located otherwise than in the condyles themselves; which makes the temporomandibular articulation a very complicated anatomic structure and a problem.

Just how simple this joint is and also how simple it is to reproduce the movements of the condyles is shown in my review of the history of the subject.[11] It may be regarded simple to closely reproduce these movements now that they have been reproduced with the three-dimensional articulator and we are able to demonstrate and visualize them.

The Wadsworth articulator represents the axis of the primary opening and closing movement to be the condyle cord and the centers of the lateral movements to be the centers of the heads of the condyles. This theory (Bonwill's) and practice have long since been discredited and discontinued.

This articulator has no provision whatsoever for the Balkwill-Bennett movement.

THE MONSON AND WADSWORTH BASIC CURVES

Monson first projected this curve (Christensen curve [sphere]) from a common center, (center of a sphere) using the divider. Wadsworth established an individual center for either side of the mandible when the sides are asymmetric, according to Morton (Needles?).

Neither Monson's or Wadsworth's curves are basic, as projected, because it is not possible to apply these curves in all cases for the reason that the relation of the ridges to these curves does not permit placement of the teeth in conformity with the requirement of the curve.

Figure 30 is a diagrammatic illustration of the Monson and Wadsworth curve, *A A*, intersecting the posterior region of the upper ridge so that placement of the upper second molars is im-

possible in some cases, which necessitates abandonment of the curve and arbitrary placement of the teeth without regard for this curve. This illustration also shows that teeth arranged to a curve, *B B*, which is possible of accomplishment and which takes into consideration ridge relation and leverage, is more practical than an attempt to arrange them to a curve with a hypothetical center, such as the Monson and Wadsworth centers.

A curve or curves can be chewed or ground in by the patient in any vertical relation between the ridges, even upside down or the reverse of normal according to nature, which shows and proves beyond question that the identical form and location of this curve may be, to a great extent, arbitrarily formed and located at the discretion of the operator, and that there is no one necessary form and location demanded in disregard for ridge relation and leverage.

George H. Wilson once said "There are two kinds of dentures, namely, mental and instrumental."

Mental dentures are made by an operator that uses his mental faculties, skill and experience, knowing that he is making good dentures and why he is making good dentures; whereas, instrumental dentures are made by an operator that uses a lot of mystifying, nonessential instruments and feels that because of the use of these things, the dentures must, of necessity, be the best.

The T square in the Wadsworth equipment, for instance, used to position the casts in definite vertical relation between the arms of the articulator, has no bearing whatsoever on the end result. The only possible benefit that could be credited to the use of the T square is that the readings of the guides are standardized, which has been very much more accurately and easily accomplished by other means.

The Wadsworth articulator, with its elaborate auxiliary equipment, presents the most extensively developed method yet devised for the making of instrumental dentures. So, if one must be instrumental in order to be happy, the Wadsworth articulator and auxiliary equipment meets his requirements, admirably.

THE HANAU ARTICULATOR

It was at my solicitation that Hanau became interested in the subject of articulators. In 1920, preceding the meeting of the American Dental Association in Boston, I went to Buffalo, called on Hanau, interested him in the subject and took him to Boston as my guest at the meetings of the National Society of Denture Prosthetists and the American Dental Association, defraying all of his expenses. After these meetings, I returned to Buffalo and worked with Hanau, acquainting him with the subject with the hope that he, an engineer, could build a truly adaptable articulator such as the three-dimensional. To date, he has failed to demonstrate such an instrument.

The Hanau articulator is a two-dimensional gothic arch articulator. There is not anything new whatsoever in principle about this articulator, nothing which was not completely covered and disclosed in the history of the development of the articulator long before Hanau was ever heard of in connection with the subject, except three-dimensional incisal guidance, which belongs to Lentz and which was first shown by me in connection with the three-dimensional articulator, shown and explained in my recent paper.[8]

Hanau's articulator (Fig. 31) presents new features in design, we grant, but we do not give it any place in the development of articulator principles as regards movements because it embodies none.

The identical principles embodied in the movements of Hanau's articulator and almost the same construction are embodied in and are available in the Snow acme articulator (Fig. 20) for $6.50, as against $35.00 for the Hanau articulator.

As long as we do not know the subject and remain ignorant of the facts, such instruments will continue to come and go at unjustifiable expense and loss of time to the profession.

The means employed in adjusting the guides of this articulator are wax checkbites. Every one knows or should know by this time that the wax checkbite in connection with full dentures is unreliable and that setting up the Hanau articulator, with its limitations and the wax bite method of setting its adjustments, as a standard by which nature should be judged and served, is ridiculous. Of course, one has to make a living, and selling face-bows and articulators is one form of occupation.

When I presented a demonstration (see Figure 85[11]) before the Illinois State Dental Society, Hanau sat before me in the audience and I especially requested, in fact urged and even dared, him to discuss the demonstration, stating "the Hanau articulator is a two-dimensional gothic arch articulator and therefore is wrong in principle and worthless." Hanau failed to respond.

Gillis, of Hammond, Ind., also sat in the audience and volunteered the statement that he had never accepted and used Gysi's gothic arch because he never believed in it. I replied "Yes, but you use and recommend a Hanau articulator that moves no other way." I have been trying for years to convince Gillis that he was inconsistent and unjustifiably misleading others. Just why he uses and supports a two-dimensional limited gothic arch articulator when a three-dimensional, fully adaptable articulator is available, I do not understand.

THE HOMER RELATOR (ARTICULATOR)

I shall discuss the Homer articulator and the instruments to follow without regard for date of their introduction.

While the Homer articulator (Fig. 32) is three-dimensional in principle and correct theoretically, this articulator is not considered a practical instrument because its mechanical construction is based upon the principle of a plastic material, which is subject to the same errors and criticisms as the plastic (wax) checkbite, discussed in my paper "Full Denture Construction."[8]

The principle of recording and reproducing mandibular relations with a plastic material belongs, as has been shown, to C. E. Luce.

If one questions the impracticability of the plastic principle, let him take a set of eccentric occlusion wax-bite registrations of a set of finished dentures, or of a set of natural teeth; mount the dentures or casts of the natural teeth in the Homer relator in centric occlusion of the teeth (Fig. 32) according to the split cast test method used by the National Society of Denture Prosthetists, as devised by Dr. Needles (Fig. 33), and make a set of composite negatives according to the eccentric bites and centric occlusion of the teeth. When through, let him see whether the centric occlusion of the composite negatives, the first negative made, agrees with the centric occlusion of the teeth, checking back to the starting point, the basis of all of the negatives. Because

of shrinkage and distortion of the compound in cooling and making the composite negatives, the first negative made, that for centric occlusion, will be observed to have been modified and rendered unfit for use as a guide with which to arrange and grind in centric occlusion, the basis of all occlusion. Furthermore, any inaccuracy in the centric negative is reflected in the eccentric negatives, and, as result of these discrepancies, this principle of recording and reproducing mandibular relations and movements is shown to be inaccurate and impracticable.

It was observed in Dr. Homer's demonstrations in Chicago that he encountered this difficulty, and that he appreciated the seriousness of such inaccuracies was proved when he attempted to rectify them by modifying the composite negatives with a hot spatula after I examined the centric of the negatives and called his attention to the fact that it was not accurate.

The split cast test method was used by the National Society of Denture Prosthetists for testing the ability of articulators to accurately check bites and reproduce positional relations of the mandible. Articulators were tested at two consecutive meetings of the above-mentioned society, held at Los Angeles and Cleveland in 1922 and 1923, with the result that no articulator tested at that time was sufficiently adaptable to accurately check bites.

The split cast test, devised by Dr. Needles, is an accurate as well as a very simple means of testing an articulator. Figure 32 shows the cast of the upper teeth demountably mounted upon a base of plaster forming a keyed seat. The cast is secured to the keyed seat by means of a nut and bolt, the nut being embedded in the mounting plaster carried by the cast and the bolt passing through the frame of the articulator and plaster forming the key seat. The bolt and nut permit ready removal or replacement of the cast (Fig. 33).

When the foregoing method for testing the adaptability of an articulator is employed, the upper cast is demounted and the teeth are fitted into a wax bite of the eccentric relation of the mandible that it is desired to test the instrument with, and the upper arm of the articulator is closed, which brings the two plaster counterparts into contact. If the articulator is truly adaptable, the surfaces of the two plaster counterparts will come together in perfect apposition; whereas, if it is not, there will be a failure of the surfaces to come together in perfect apposition.

The test suggested and outlined for the Homer relator follows:

On completion of the composite negatives, demount the upper cast and position the teeth in centric occlusion and, guided by the centric negative, forming the opening and closing hinge, close the articulator, bringing the surfaces of the plaster counterparts together, and note whether they come together in perfect apposition. The chances of the surfaces coming together in perfect apposition are very remote, and in their failure to do so (Fig. 34), the plastic negative principle is proved to be inaccurate and impracticable. A favorable result is possible and may be shown in a certain test or in one especially made to discredit the claim that the principle is not accurate and practicable, but, as a method for every day use in regular practice, the principle will fail to prove sufficiently accurate and dependable to be practicable.

Any discrepancy shown because of failure of the plaster counterparts to come together represents to what extent centric occlusion (the bite) has been

thrown off and also indicates that the eccentric negatives are likewise and correspondingly inaccurate.

In discussing John H. Hospers' paper on Homer's articulator before the Illinois State Dental Society in Springfield, Ill., in May, 1929, I made the foregoing statements and challenged Dr. Hospers to make the test outlined, using my own case, I having previously prepared and mounted casts of my teeth in the Homer articulator for the meeting. Dr. Hospers declined to make the demonstration, stating that he suspected a "trick" of some kind. Since the meeting, I have succeeded in getting him to make the test. The result of the demonstration was exactly as I anticipated. When the compound hinge (centric negatives) were caused to direct the closure of the instrument, the plaster surfaces failed to come together, in the identical manner shown in Figure 36. Gale M. Hambleton, of Chicago, witnessed the test as made by Dr. Hospers and observed the result here reported.

After deliberating over the result of the foregoing test, Dr. Hospers called me on the phone and informed me that he had me down on "that" test and I had better be careful what I reported, that I had malocclusion and if I would get a full mouth set of roentgenograms of my case, he would show me something. I answered him that my understanding had always been that occlusion of the teeth primarily was supposed to be studied and diagnosed with articulators rather than roentgen rays and suggested that I call in a patient with full dentures and mount his case in the Homer articulator and let Dr. Hospers repeat the test under conditions entirely controllable with the Homer instrument, which he claims to be the only "truly" adaptable articulator. To this he agreed, and the second test was made, with the identical result as the first (Fig. 34). At the close of the demonstration, Dr. Hospers said, "Well, it's not my work anyway, it belongs to Homer." This is a splendid example of one of the reasons for the articulator controversy. Men fail to test such things before they act and speak.

That Dr. Hospers might from this point on know just what a "truly" adaptable articulator is expected to do and can do, I gave him a demonstration and showed him how perfectly and how easily the discrepancy shown in Figure 34 was prevented or eliminated with the Hall three-dimensional articulator. I provided Dr. Hospers with one of my three-dimensional articulators to test when I first brought it out and he returned it unused.

THE GYSI TRUBYTE ARTICULATOR

The Gysi trubyte articulator (Fig. 35) is a two-dimensional gothic arch articulator and cannot, therefore, reproduce the arcuate movement of the mandible and accurately check three-dimensional positional relations of the mandible. This articulator presents no improvements either with regard to movements of adjustable construction not previously disclosed in the art by others or by Gysi himself, already noted and discussed. It embodies: (1) Walker's adjustable downward condyle path; (2) Walker's variable lateral rotation centers; (3) Hall's principle of incisal guidance (Fig. 22) for reproducing the gothic arch movement of the incisor point, and (4) adjustment for the Balkwill-Bennett movement, both as to principle and construction, belongs to Gysi.

Gysi has returned to the condyle cord as the axis for the opening movement in the trubyte articulator, abandoning the more anatomic point (back of and below

the condyles) previously employed in the adaptable and simplex articulators and to which he is altogether too well committed in the past to drop without criticism.

Outside the one feature credited to Gysi, that of embodiment of the Balkwill-Bennett movement and possibly the incisor guide pin and guide, it is shown that his articulators are all copies of articulator principles and construction previously embodied in other articulators. So Gysi's articulators that we hear so much about are mainly the work of others. Gysi himself is fair in regard to this fact. He has given credit where credit was due, as far as I have been able to determine, but he has been so promoted and pictured as to make obscure, and cause to be forgotten, the importance of the work of others, as well as caused to sacrifice some of his own claims and ideals in the science of the subject.

I accept Dr. Gysi's findings and work as originally introduced in *Dental Cosmos* in 1910, allowing for their incompleteness and limitations, as being scientific, consistent and correct. I do not recognize Gysi's more recent work and articulator, the trubyte, as a fair exemplification of his earlier work and teachings.

Walker was the most outstanding designer of articulators. The only improvement of importance that has been added to adjustable articulators since Walker's articulator in 1896, until the advent of the three-dimensional articulator, is the Balkwill-Bennett movement by Gysi and incisal guidance by Luce or Gysi.

This brings us to the present period in the development of the articulator, which I believe to be final in regard to accuracy in reproducing positional relations and movements of the mandible. It has to do particularly with the three-dimensional principle shown, demonstrated and explained by me.[8]

For years, I have pointed out the shortcomings of articulators, particularly with regard to the movements of the mandible on the working side. The relations and movements of the working condyle have been far from accurately reproduced. And, to liken the mandible to the three points of the triangle (Bonwill), the movements of the working condyle are at least one third, if not more, of the story in importance. They are more closely related to the working part of the masticating apparatus. Therefore, it is seen that only two thirds of the story has been told or accounted for in articulators. Accurate checking and recording of lateral positional relations of the mandible (see my first article[8] and Figures 38 and 39 of this article) discloses that the third point of the triangle—the working side—moves in all directions. It is found to move forward, downward, upward, and backward and to move in combinations of these directions or it may form a pivot as the center of the movement.

Such positional relations and movements are relations and movements in three dimensions and require in turn three-dimensional guidance with which to reproduce them. The three-dimensional guide described in my previous article has no limitation, it is universal and may be adjusted in any direction within the sphere and will check any possible position of a point and direct its movement from one position (centric relation) to another position (eccentric relation), and vice versa.

I have contended for years that attempts to check bites with casts mounted in hinge-connected articulators were successful only as far as the limiting restraining hinge connection and guides of the articulator permitted the casts to seat

themselves in the bite. The absolute checking of bites cannot be accomplished until the articulator mechanism is perfected so that the arms can be entirely disconnected, permitting absolute placement of the casts in the bite, after which the guides of the articulator may be adjusted to coincide, as previously shown and explained.[8]

The conventional type of articulator, connecting the two arms with a joint in the form of a hinge, is restricted and limited as to adaptability. Therefore, this type of construction in itself disqualifies all articulators so constructed up to the present time. And this construction is embodied in all articulators now in use with which I am familiar, except the three-dimensional articulator.

There is no restraining hinge joint connection in the three-dimensional articulator and the three-dimensional guides afford mechanism capable of recording and reproducing any positional relation of the mandible.

Gysi, in his paper before the 1928 meeting of the National Society of Denture Prosthetists in Minneapolis, made the statement that "the three-dimensional instrument designed by Dr. Hall is all that Dr. Hall claims for it." It was noted, that Dr. Gysi in his address before the meeting of the American Dental Association in Minneapolis in 1928 and the Chicago Dental Society following, did not mention my name or comment on my work. However, in his published article in the JOURNAL,[25] following the above mentioned meetings, he does mention my name and concedes the three-dimensional principle embodied in the Hall articulator. How Gysi can acknowledge the correctness and efficiency of the three-dimensional principle and be so inconsistent in his conclusions and recommendations in his own work is beyond understanding. Gysi's original work was scientific and consistent as far as it went and it stands undisputed. Today, retrogression is markedly evident in his conclusions and recommendations. This situation I do not credit to Dr. Gysi directly.

Gysi also acknowledges and accepts Stansbery's three-dimensional checkbite method of registering positional relations of the mandible as scientific and practical. I should like to see, and I here challenge him, or any one of his followers, to check or record Stansbery's three-dimensional registrations of edentulous cases or bites of my own mandibular relations with his latest instrument the "trubyte" articulator, or, for that matter, with any of his articulators with which we are familiar. This challenge was made to Dr. Whittimore and Dr. Clapp when they introduced the "trubyte" instrument to the members of the Prosthetic Society at the Philadelphia meeting in 1926 at the time I demonstrated the ability of the three-dimensional articulator to check any bite. They declined to demonstrate the trubyte articulator, giving the excuse, "We have not the authority to demonstrate it." Is there not some inconsistency shown in exhibiting an instrument in public and the claim that they had no authority to demonstrate it? And in the face of all of this, they placed this very instrument on the market clothed in the most extravagant claims.

Hanau was also urged to demonstrate his articulator in comparison with the three-dimensional instrument, and he likewise showed good judgment, with the statement, "I am not working during this meeting." Neither Gysi nor Hanau can check lateral bite relations of my

25. Gysi, Alfred: Practical Application of Research Results in Denture Construction, J. A. D. A., 16:199 (Feb.) 1929.

mandible with their articulator—Hanau's "kiniscope" included.

Hanau has recently added a "makeshift" three-dimensional incisal guide to his instrument, indicating his understanding of and appreciation for three-dimensional construction. Why does he show partiality to the anterior point of the triangle? To be consistent, he will have to add the same to the two posterior points of the triangle, in which case he will again end with a copy of another's work, a three-dimensional articulator.

I wish at this time to introduce extracts from a correspondence between the Dentists' Supply Company and myself. I do this to show what unfair conditions surround this subject, and with which the individual worker has had to contend.

After their announcement that the Gysi "trubyte" articulator had been awarded the "Grand Prize" at the Sesqui-Centennial Exposition in 1926 (Fig. 35), and their representatives' refusal to demonstrate the adaptability of this instrument, I had some correspondence with them in the course of which I stated, under date of April 26, 1927.

You feature the award of the "Grand Prize" as being a great achievement and credit to the instrument and state in your letter "you believe I will be glad to have the facts to guide me in any future reference to the subject." Were I in possession of a little further information I could more intelligently judge and discuss the merits or importance of the award. Please answer the following questions:

(1) Were there any articulators other than the Gysi trubyte articulator before the International Jury of Awards competing for the award? If so, name them.

(2) Who constituted the International Jury of Awards? Were they men capable of judging the merits of an articulator and was there even a dentist among them?

(3) Upon what claims did the jury grant the award for the articulator and what tests did they make to substantiate the claims?

Personally, I am of the belief that the jury did not have any one on it experienced in the subject to pass judgment upon the merits of the instrument and that the award means absolutely nothing whatsoever to dental science. Furthermore, it is my feeling that, for you to seek, accept an advertise, such an award is unfair to those [illegible] is giving freely of our time and money to investigation in the subject. Were I to do the like with my articulator, I would consider the act unethical. And, in justice to Dr. Gysi, I venture the statement that I do not believe that he had anything to do with the act or that he would approve of it.

We have but one body that could be regarded a jury in such matters and this is the National Society of Denture Prosthetists. Your Dr. Whittimore, assisted by Dr. Clapp, exhibited the new Gysi "trubyte" articulator before the above society in Philadelphia. The writer challenged them to check bites of his own case and demonstrate the adaptability of the instrument before the society and the members present heard them decline the opportunity to make such a demonstration, offering the excuse they had not the authority to make such tests.

I would like at this time to renew my challenge to you to make the above demonstration at the oncoming meeting of the National Society of Denture Prosthetists, in October, at Detroit. I will have casts and bites ready for the tests.

I think the members of our Society would like to see the claims you make for the instrument substantiated. I assure you that I, as a member, would like very much to see such a demonstration. My years of study of the movements of the mandible and building articulators does not permit me to accept the claims you make nor does it indicate that you can substantiate such claims.

Awaiting your reply and hoping you will accept my challenge, I am

Yours truly,

(Signed) Rupert E. Hall.

This challenge has never been accepted nor have the specific questions been answered.

One would be led to believe from the publicity given Gysi that he was the only authority worth considering on the sub-

ject. We accept that Gysi has done a great amount of research work and that he has contributed and assisted tremenduously in furthering scientific investigation and in raising the standard of practice in this branch of dentistry, but we are unwilling to concede that his work is the last word or that his recent recommendations and attitude are even in accord with his more scientific and consistent teachings and practices of the past.

Note in the "Grand Prize Winner" ad (Fig. 35) it is stated that the Gysi trubyte articulator "Reproduces all known masticating movements of the mandible." Why, if this is true, does the Dentists' Supply Company also recommend and offer for sale the Phillips articulator, selling at upward of $100.00 with all of its complicated and impracticable mechanism? Would it not seem that the trubye articulator was sufficient and answered all requirements of an articulator?

The Phillips articulator (Fig. 36) is a three-dimensional articulator in principle, but is so constructed mechanically as not to permit a sufficient workable range of adjustment of its guides to make it fully adaptable. It is, therefore, not capable of recording and reproducing all mandibular relations and movements and is unnecessarily and hopelessly complicated and cumbersome and for this reason is not practical, especially in view of the fact that fully adaptable, less complicated, less cumbersome and more practical instruments are available.

The method of use of this instrument, advocated by its designer, Dr. Phillips, is adjustment of the guides to two-dimensional gothic arch registrations after Gysi, purporting to reproduce, therewith, the composite mandibular relations and movements with one adjustment of the one set of guides. This practice I have shown, and shall again show further on in this article, to be incomplete, inaccurate and impracticable. Phillips advocates averaging the Balkwill-Bennett movement in his articulator. This will never do in consideration of our knowledge of this movement and of its importance.

We note by the ad (Fig. 37) that Dr. Gysi is astonished at the precision with which the trubyte articulator is made.

I have a new Gysi trubyte articulator in my office and it is so inaccurate in construction that even centric relation is lost when loosening the lock screws so it can be moved anteroposteriorly and laterally. I have been informed that the manufacturer is aware of this inaccuracy and that attempts have been made to correct it, sale of the inaccurate instruments, continuing to be made in the meantime. Russell W. Tench was my informant in this matter, and it is with his consent that his name is used in this connection.

I know of nothing in connection with dentistry that has associated with it so much "bunk" and argument as the articulator question. I may be accused of being argumentative and of having handed out my share of bunk. This I admit, but there is a difference in being innocent that you are wrong and in knowing that you are guilty of being wrong. There has never been a time that I did not believe in and was not absolutely sincere and honest in everything that I have stood for in this subject. That I have changed my mind and retracted certain of my former claims is no disgrace to me or to anyone. In fact, if some others were as willing as I to listen to reason and as open to correction, it would improve the situation as regards this subject.

Until I constructed the three-dimensional articulator and demonstrated its ability to register and reproduce accurate-

ly any and all mandibular relations, I labored under the understanding and belief that such a solution of the articulator problem was earnestly and conscientiously sought by the entire membership of the profession, including the manufacturers, and that the principle would be accepted and acclaimed. To my great surprise—and disappointment—I find that the articulator controversy goes on as it did before; that many of the profession, and certainly the manufacturers, are influenced by ulterior motives and that others are interested only in an argument; and that, further than this, if you please, the subject has, with some, even become a game in which they indulge as a pastime and as a sport, while the more serious minded of us carry on and furnish the material for the game.

Dr. Johnson's editorial[26] calling attention to and deploring this situation was not at all out of order. At the time, I did not agree with his point of view, but I now concur with him in all that he said.

There has been considerable speculation as to just what prompted Dr. Johnson to write this editorial. The accusation that, through a certain source or sources, he had been led to believe the subject was controlled by certain men, or groups, and that certain others with worthy ideas were being denied the privilege of a hearing, etc., etc., has been and still seems to be a prevalent opinion.

I have never believed this, and I have recently talked to Dr. Johnson about the matter. He states emphatically that such is not the case. Dr. Johnson agrees that he wrote the editorial in question for the very same reasons that I have written this paper, namely, to awaken the profession to the fact that there is an unwarranted, personal, destructive and disorganizing articulator controversy going on and that it is time the situation was analyzed and remedied.

George Wood Clapp tried to have the National Society of Denture Prosthetists' adjustable articulator specifications that were written at the Louisville Meeting in 1925 rewritten at the Minneapolis Meeting, removing certain stipulated requirements which the Gysi trubyte articulator could not meet, and limiting the remaining ones to specifications that would permit this articulator to qualify accordingly. This he was not able to do. Russell W. Tench, of New York, objected, and his objection was sustained, and, on my suggestion, the specifications were again tabled for another year, my contention being that it was a mistake to put out such specifications and recommendations to the profession until we ourselves solved some of the existing problems, such as I have discussed in this and my previous articles.

I opposed the specifications in question at the time they were drafted in Louisville because there was no adjustable articulator in existence at that time that could meet the requirements. When I stood for and recommended tabling the specifications at Minneapolis, I had the only adjustable articulator that could meet the specifications, an articulator which I made especially for the purpose of fulfilling the specifications outlined by the society at the Louisville meeting. This fact had no influence on my better judgment; I thought it best to withhold the specifications. Releasing the specifications would have meant a great deal to the three-dimensional articulator commercially.

I vigorously opposed the adoption of the adjustable articulator and face-bow

26. What Is Wrong? J. A. D. A., 14:1116 (June) 1927.

specifications at the Louisville meeting and have consistently done so ever since. My statement, there, was that no one could accurately determine mandibular relations for adjustment of an articulator if we had a fully adjustable articulator. Stansbery remedied this difficulty when he gave us his three-dimensional check-bite technic, but new complications have since arisen which cause me to still feel that a fully adjustable articulator is without accompanying means for accurately determining and registering mandibular relations in all cases. I refer to the gothic arch centric relation of the mandible versus the functional centric relation of the mandible determined, shown and explained by me in my article "Full Denture Construction."[8]

It is my aim and always has been to be consistent and honest in this subject, and I believe that, since I have built and demonstrated the three-dimensional articulator that does all we have talked about and have tried to get articulators to do, fulfilling the National Society of Denture Prosthetists specifications to the letter, and have then made criticisms derogatory to the welfare of my own instrument, I am gaining recognition for this fact. I am sorry that I cannot think this way about some others engaged in the subject and promoting the sales of articulators.

Clapp's proposal to modify the specifications was a case of inconsistency and unfairness, not tolerable because every one knows that Gysi formerly tried to imitate and recommended exact imitation of the mandibular movements. Today, Gysi is averaging certain of the movements of the mandible and not attempting to imitate certain other movements that formerly he described and tried to imitate.

Quoting Gysi in *Dental Cosmos* (1910): "The longer we study the movements of the mandible, the more shall we be astonished at their infinite variety" and "The problem of articulation will not be solved until the mandibular movements can be exactly imitated —not only for the average normal case but for each individual one."

Note in Gysi's specifications that there are no exceptions, that the specifications are unequivocal—movements must be *exactly* imitated.

It is noted that Gysi has just recently reaffirmed his belief in the gothic arch movement as the correct premise for articulator movement. In his last appearance in this country,[25] he stated (under the sub-heading "Relative Importance of the Movements of the Mandible"), "I now regard the record of the lateral movements of the mandibular incisor point as the most important of all records of movements."

Gysi erred in the beginning in adopting this movement as a premise for lateral movement for his articulators and has now, after all these years of observation and experience, not only reaffirmed his belief in this movement, but, as it is seen, placed the whole of his faith on this one movement as the one most important consideration of all movements. I should like here to point out that the movement of the incisor point is a resultant of mandibular movement and not a cause or directing factor in its movements. Therefore, reproduction of the movement of this point is of no greater importance than that of any other point and it does not follow that correct reproduction of the movement of this point insures correct movement of the other points.

There is no scientific justification whatsoever for Gysi emphasizing the

movement of this point as he does. I consider the movement of the condyle on the working side the most important movement.

Preceding the foregoing statement, Gysi (page 204), under the heading "What Determines Interdentation," said, "The exact interdentation of the bicuspids and molars during the masticatory movements is determined by the movements of the three main points of the mandible, that is, the two condyles and the incisor point.

The condyles are capable of making the following definite primary movements. During an incising (protrusive) bite, they move directly or sagittally forward and downward. During a lateral bite, they move slightly inward on the balancing side and outward on the working side. This inward-and-outward movement with relation to the sagittal plane is known as the Bennett movement.

Correspondingly, the incisor point moves forward and downward during an incising bite and more or less laterally during a lateral bite. The record of these movements toward right and left, when traced by the mandible on a recording plate, forms the gothic arch."

I should like to see Gysi prove the statement that "The record of these movements toward right and left, when traced by the mandible on a recording plate, forms the gothic arch," by demonstrating the tracing of a gothic arch on a recording plate the surface of which is disposed in the horizontal plane in a case with natural teeth with cusps and overbite, such as his statement infers he has proved. If he has not proved this statement by demonstrating it, let him try to do so, and he will find that, in place of the tracing forming a gothic arch, as it does when traced without the opening movement functioning, it will outline an arc or a very much modified (flatter or greater angle) gothic arch as compared with that secured without the opening movement functioning. This fact I demonstrated at the meeting of the National Society of Denture Prosthetists in Detroit in 1927, using my own mandible for the test and demonstration (Fig. 86[11]).

Quoting Gysi further (page 201), (under the heading "Necessity of Mandibular Movements Governing Tooth Forms"): "I showed conclusively, several years ago, that the artificial teeth which are to offer us the greatest opportunities must be correctly carved for the manufacturer, and that this can be done only by reproducing, in a properly constructed articulator the average of a large number of mandibular movements."

For the same reason that Gysi's articulator is wrong, his teeth (trubyte and crossbite) are wrong, because they are carved in his articulators which move on the principle of the two dimensional gothic arch movement instead of in articulators that move on the three-dimensional arcuate principle—a blow to Gysi's and the Dentists' Supply Company's work and products, but true according to my analysis of the movements of the mandible and Gysi's articulators, in which instruments they make known that Gysi carved the trubyte and crossbite teeth.

Every set of three-dimensional registrations that I have taken (wax bites of natural teeth, or Stansbery plaster bites of edentulous cases) have called for adjustments in the three-dimensional articulator that indicate and direct an arcuate character of lateral movement (see adjustments illustrated in previous paper[8]), except the one case reported[8] in which the lateral movement for one side was a movement of gothic arch character. The three-dimensional checkbite and the

three-dimensional articulator record and reproduce either character of relation and movement, settling all arguments as regards mandibular movements, registration of mandibular movements and articulator adaptability, regardless of whether the movement is gothic arch or arcuate in character. They also demonstrate the importance and requirement of registering and reproducing every relation of every part of the mandible in every dimension.

The point of the gothic arch movement versus arcuate movement is now one of theoretical interest only, because, with the three-dimensional bite and the three-dimensional articulator, we are able to check and reproduce the patient's mandibular relations, whether they move in accordance with a gothic arch, arc, about the axis of a cone or the center of a sphere, or what not.

It is hoped that it is now clearly understood that Gysi is basing his opinions and statements on registrations of the mandible secured in two dimensions without regard for the third dimension (opening movement); whereas, I am discussing the relations of the mandible in three-dimensions, in which case further debate with Gysi on this point is of no especial value or interest as it has been clearly shown that the premise upon which he works is incomplete and wrong.

In one case presented with the Bennett movement functioning in the opposite direction to normal, i. e., in left lateral relation, the condyles moved to the right instead of to the left. Gysi's arbitrary fixed average lateral movement employed in the adjustable instrument that he uses in Switzerland (Fig. 23) and Hanau's mathematically calculated lateral movement, which are in normal direction, fail to meet the requirements of such a case. They are not even moving the mandible in the right direction. Average or mathematical deductions will not answer, and, in this respect, both Gysi and Hanau are wofully lacking, inconsistent and inexcusably unscientific. It is as important to record the direction and degree of this movement as it is any other movement of the mandible.

It is regrettable that we are obliged to point out that Gysi has made unscientific and inconsistent compromises in his work. Since the advent of the three-dimensional articulator, he *tries* to minimize the importance of recording the relations of the condyle on the working side after stating that "the problem of articulation will not be solved until the movements of the mandible can be *exactly* imitated."

Figure 38 shows adjustment of the guides of the three-dimensional articulator to a right lateral bite, demonstrating an extreme condition.

The Stansbery checkbite technic was employed in this case. The case was checked by Stansbery himself in my office, after which I spent ten days verifying his findings with several series of like bites made by myself and further with the central bearing test shown in Figures 18 and 19 of my previous article.[8]

The readings of the adjustments of the guides in the region of the condyles indicate that the condyle on the balancing side moved forward, upward and inward at angles of approximately 18 degrees inward (Balkwill-Bennett) movement and 18 degrees upward movement, and that the condyle on the working side moved backward, outward and upward at angles of approximately 18 degrees outward and 60 degrees upward movement.

The stop forming the seat for the ball in centric relation in the three-dimensional guide on the working side is tilted so high as to practically destroy its function as a rest for the ball in centric rela-

tion, and in order to clear the edge of the stop with the stems carrying the balls, the stems, a special set (Fig. 39) had to be bent at right angles to permit perfect seating and functioning of the balls in the guide channels.

A set of full dentures arranged and ground in to these registrations (the opposite lateral relation was the same in character) tested out and corrected with the central bearing equipment (Figs. 18 and 19[8]), and further perfected by having the patient chew carborundum, disclosed a new and spectacular condition in full denture restorations, namely, the buccal cusps of the lower teeth were shorter than the lingual cusps and the buccal cusps of the upper teeth were longer than the lingual cusps, a reversal of the lateral aspect of the curve of Spee. While this is a new disclosure in full denture work, it is an old one in natural teeth, the condition often presenting in worn down natural teeth.

The disclosures in this case demonstrate the extreme complexity of the temporomandibular joint and the intricate equipment and exacting technic required to register, record and reproduce accurately the relations of the condyles in the various occlusions. They also demonstrate the apparent utter impossibility of constructing a single set of three-dimensional guides capable of recording the composite relations and movements of the mandible with one adjustment of the guides, as attempted by Phillips and with the use of compound negatives.

Would Gysi dare try to discredit the importance of registering and reproducing the relations of the working condyle in this case? It is by far the most important of all three points of the triangle.

There has been no articulator or technic available, until the advent of the Stansbery checkbite technic, and the Hall three-dimensional articulator, that would detect and accurately register and reproduce such mandibular relations.

I do not believe Hanau's laws of occlusion cover this form of occlusion and if it is incorporated in them, he will be unable, as he is in most cases, to meet its requirements with his present articulator.

A hinge type articulator confronted with the requirements of this case finds itself in a very helpless predicament, and the authors and sponsors of this type of articulator are hopelessly unable to substantiate the claims that they make for them.

The new "trubyte" articulator, which carries Gysi's name and endorsement, is incapable of recording these relations. Neither are any of the other articulators now on the market, such as the Snow, Wadsworth and Hanau.

If we are to have complete adaptability in an articulator, we must record and reproduce the relations of the condyle and mandible on the working side. The three-dimensional articulator absolutely and perfectly records the relations of the condyle and mandible on the working side; in fact, it records every relation of the entire mandible in every detail, as determined by the checkbite, averaging or omitting nothing.

The importance of recording and reproducing the relations of the condyle on the working side is unquestionable. It is folly to register and reproduce the relation and movement of the balancing condyle and not that of the working condyle. It is this movement not accounted for in the movement of articulators and in the construction of prosthetic restorations that is responsible for much impaired function and trauma, both in full dentures and in crown and bridgework. It is the one mandibular relation and movement that has outwitted investigators and

builders of articulators of the past, and it is the one most important consideration in the problem. These movements are more closely associated with the functioning teeth on the working side than are those on the balancing side and at the incisor point.

If the articulator controversy must continue, which I trust it does not, it is to be hoped that the Bureau of Standards, or some other unbiased body, will take up the matter as they have the question of materials, etc., and analyze it and report their findings. The United States Government has a mechanical engineering department, and it would not take it long to put a stop to the situation as it has in other similar matters and the profession would then be saved from a continuation of the controversy and the useless expenditure of much time and money.

I have made inquiry in this direction hoping to bring this about, if necessary, and am anxious to be the first one to put his work on the table for analysis if such opportunity arises.

That I have written at length on movements of the mandible and articulators and in defense of my own ideas and instruments is not to be construed as intended to modify the things that I said and stood for in my article, "Full Denture Construction,"[8] under the heading "Modern Denture Prostheses, So-Called, Overspecialized and a Failure."

To be more specific and to avoid any possibility of being misunderstood, I repeat that I do not believe in adjustable articulators for the various reasons to which I have called attention in my articles. Furthermore, I believe more than ever that the inverted cusp tooth has solved the problems heretofore assigned to and expected to be solved by articulators. I have prepared these articles that I might be on record with my ideas and the work that I have done and with the hope they may be of value to my profession as I believe them to be to me.

LEGISLATIVE AND RESEARCH ACTIVITIES OF THE AMERICAN DENTAL ASSOCIATION, TOGETHER WITH A RÉSUMÉ OF SOME ESSENTIAL FACTORS CLOSELY RELATED TO OUR PROFESSIONAL ADVANCEMENT*

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YOUR program committee has invited me to review the legislative and research activities of the American Dental Association and to give other important data in order to present a résumé of some of the essential factors in the advancement of the dental profession.

If an active interest in certain problems, together with a long and varied experience, equips a person to discuss such an inclusive subject, I can possibly qualify for this assignment. But in so doing it becomes quite embarrassing to me, since my activities have been so closely interwoven into the general theme

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that it is impossible to do other than present a record of some of my organizational actvities; but I will endeavor to do this as impersonally as is possible under the circumstances. However, I, like others, have probably remained quiet long enough and have permitted misinformation to be broadcast until the repetition of such statements can soon be accepted as established history and substantiated by such records. As an evidence of this, I need refer to only two instances:

First, the preliminaries of the reorganization of the National Dental Association were completed at the 1912 meeting, held in Washington, to become effective with the election of the officers the next year at Kansas City, as per the following resolution, adopted Sept. 13, 1912:

> *Resolved,* that at the 1913 session of the National Dental Association and on the third day thereof, the first House of Delegates shall convene for a single session for the election of officers, the appointment of Committees, and such other business as may be necessary for placing the new constitution in operation, and the same members composing the house of Delegates shall serve as the House of Delegates at the session for 1914, and their terms of office shall begin thereat.

Thus, all the preliminary and necessary work had been accomplished for the reorganized national association to start off with a membership of approximately 12,500 by the time of the first year's meeting. In support of this, I refer you to the *Official Bulletin* Number 1, published in November, 1913. I trust that I shall be pardoned for taking some satisfaction in the fact that as Secretary of the National Dental Association, secretary of the Reorganization Committee and chairman of the State and Local Societies Committee, I had charge of all the details of this work. In this, as in nearly all other progressive movements, we met with opposition from many sources and it was necessary to develop enough interest to overcome this feeling, and in this connection, R. Ottolengui rendered us a more consistent and helpful service than any other person. In the face of all of this, I have heard it publicly stated on more than one occasion that Otto U. King, who succeeded me as Secretary at the 1913 meeting, when I was elected President, took over the active executive work of the Association when its membership was limited to approximately 700 and that through his efforts it grew to a membership of approximately 35,000. I have heard Dr. King make this statement, as well as others; but they were made at a time when it would have been quite out of place to have refuted them. Attention was later called to these misstatements, and I herein repeat this fact as a part of this résumé.

Secondly, I have also heard it intimated, as well as definitely stated, on a number of occasions that William H. G. Logan was responsible for the equal status legislation enacted by Congress, Oct. 6, 1917. Only recently a dental journal which is supposed to go to every practicing dentist in this country gave Dr. Logan credit for this legislation, as follows: "He was instrumental in getting Congress to pass a bill giving the same rank to the Dental Corps as that enjoyed by the Medical Corps in the United States Army." Regardless of this statement, as well as all others that have been made by different persons at various times, this is incorrect. The facts are that he was not instrumental in having this legislation enacted, but that we were able to get Congress to pass this bill in spite of his indifferent attitude, if not direct opposition, and this is set forth in the National Dental Association records of the meeting, held in New York City, Oct. 23-26, 1917.

However, I want it distinctly understood that I appreciate the ability of both Dr. King and Dr. Logan, as well as the many valuable contributions that they have made to the advancement of the dental profession. These have been quite sufficient to establish their services as highly meritorious without anyone's attempting to take or give credit to them to which they are not entitled. In both this reorganization and this legislative work, there were many who generously contributed their time and effort, and Dr. King, as secretary of the Indiana State Dental Society, loyally cooperated in the reorganization work, and likewise, as Secretary of the national association, in our legislative work. In both of these accomplishments, there is credit enough for all those who actually assisted, and I do not desire to withhold proper recognition from anyone. On the other hand, I know all these facts and details and look on my activity in these two problems as my greatest contribution to the advancement of our profession, and I do not propose to sit idly by and permit others, or their friends, to misstate facts and base dental history on and through such misrepresentations. In this connection, I think that I shall be justified in quoting the inscription engraved in a beautiful Swiss watch presented to me at the time of the national meeting held in New York City, Oct. 23-26, 1917, as follows:

Presented to Dr. Homer C. Brown, Chairman Legislative Committee, National Dental Association by the Association of Military Dental Surgeons of the United States in appreciation of his untiring efforts to place Dentistry on an equal plane with Medicine in the public services, culminating in success on October 6th, 1917.

FIRST LEGISLATIVE EXPERIENCE

During the 1900 session of the Ohio General Assembly, a bill was introduced to amend the existing law regulating the practice of dentistry. The late A. F. Emminger was chairman of the Legislative Committee and he wrote me requesting that I appear before the Senate Committee at the time of the hearing on this bill. He did this because Sen. H. P. Hanna of Gallipolis, where I was practicing, was a member of the Senate Committee to which this bill had been referred. I recall the following in connection with this hearing:

The two bills considered related to the practice of medicine and dentistry, but most of the discussion was confined to the medical bill. I also recall that Attorney Franklin Rubrecht was present with Dr. Emminger, as his legal advisor, and spoke in support of the proposed legislation. Only a few dentists were present, and I had traveled farther than any of the others in order to comply with the request of the chairman of the committee. I also recall that the late President Warren G. Harding was a member of this committee, and he made a very favorable impression on me as a vigorous, broad shouldered gentleman of pleasing personality. He was interested particularly in the medical bill, as his father was a physician.

However, this dental legislation failed, and before the next meeting of the general assembly, George H. Wilson, of Cleveland, was appointed as a member of legislative committee of the Ohio State Dental Society and given full authority to promote the necessary legislation in order to raise the standards of our dental law to be in harmony with the requirements of practice at that time. Dr. Wilson was very enthusiastic in this new activity, and as I had previously served with him on the clinic committee of the state society, he wrote me at Gallipolis, stating that he understood that I was contemplating moving to Columbus

and, if such was the case, that he had some special work that he wanted me to look after. As I had already moved, his letter was forwarded and I assumed that I was going to have a new patient, but such was not the case, as his second letter discussed this legislation and solicited my cooperation. He came to Columbus soon thereafter, and we thoroughly reviewed the situation and outlined a legislative campaign, which proved successful.

Dr. Emminger was still chairman of the legislative committee and a member of the state dental board, but was not active in this legislation. Harry M. Semans assisted in this work, and no doubt recalls some of the handicaps which confronted us from time to time. After the bill was passed, it developed that an error had been made in engrossing it, or in some other manner, which destroyed the entire purpose of the law, but fortunately I discovered this in time to have it corrected during the closing hours of that session. The enacted law provided for the appointment of a new board of dental examiners, and my activity in this legislation was recognized by Gov. George K. Nash appointing me as a member, and when the board organized, I was elected secretary. Later that year, I was appointed a member of the legislative committee and I have served on this committee the greater part of the time since then and, as chairman, I have had charge of all state dental legislation that has been enacted since then with the exception of that providing for reregistration; at least, this is the only exception that I recall. The dental legislation enacted during the last session, which adjourned April 16, is no doubt more constructive and far-reaching in character than any heretofore passed at any one session. This authorizes boards of education to employ school dentists under the same conditions that they employ school physicians and provides for an educational oral hygiene program being put into operation by the state department of health.

FEDERAL LEGISLATION

My first connection with national legislation was in 1908. At the meeting of the National Dental Association held in Boston that year, I was elected Corresponding Secretary, and the legislative situation in Washington had become so complicated that the Executive Council, the controlling body of the Association at that time, named the elective officers as the Legislative Committee. In explanation, I will say that there were two dental societies in Washington and likewise two very positive factions. Otherwise, the conditions were favorable for the local professions assisting in promoting approved legislation. This is also true with the various state capitals, as the local men come in contact with the members of the state legislatures and are thus able to develop valuable support. What is true in the various states is doubly so in Washington, since Congress is in session much longer than state legislatures and many of the Senators and Congressmen become more or less permanent residents of Washington. But an unfortunate situation prevailed there; that is, when one group favored certain legislation, you could rest assured that some of the others were going to oppose it, regardless of its merit, and this was responsible for the elective officers being selected as above noted.

That year was no exception, as we were promoting some Army Dental Corps legislation and our committee met in Washington on several occasions. Through the regular course of legisla-

tive procedure, such bills are referred to the departments directly interested, and the Surgeon General of the Army had rendered an adverse report regarding our legislation; but this was nothing unusual, since it was well known that the officers of the Medical Corps were not disposed to look with much favor on anything relating to the dental profession. However, through some diplomatic maneuvering, it had been arranged that if the bill could be informally returned by the Military Affairs Committee of the House, the Surgeon General would make some slight modification in its phraseology and then approve it. We had spent considerable time in an effort to get this bill returned, but without success. The other officers were older and more experienced, but after exhausting every possible resource, they asked if there was not someone from Ohio that I could get in touch with who had influence enough to bring this about. It so happened that Senators Foraker and Dick, the Ohio Senators at that time, were both out of the city, and I informed them that Congressman Theodore E. Burton was the most influential man from Ohio available. He had just recently been elected to succeed Senator Foraker, but had not taken his seat in the Senate. They inquired as to whether I knew him and fortunately I had met him on two or three occasions and was willing to see what could be accomplished. Therefore, the next morning, we started out to interview Congressman Burton and fortunately we located him in the House of Military Affairs Committee. We waited a short time until they adjourned, and I first congratulated him on his promotion and stated that I was present at the time of his election by the general assembly of Ohio, but that I could not wait to congratulate him that morning. He expressed surprise that I was there, when I told him that my friend J. O. Hawkins, a member of the Legislature, had invited me to be his guest that morning. Then he asked, "Are you the Dr. Brown who is a friend of Dr. Hawkins?" I told him that I was, and he proceeded to express his appreciation of the service that I had rendered him in securing the support of Dr. Hawkins for his election. He stated that a certain prominent Ohio politician had informed him that he would be able to get Dr. Hawkins' support for him through me. While it is true that the gentleman in question made inquiry of me, some time before this, regarding my knowing Dr. Hawkins, he had not gone so far as was indicated; but it was not the psychologic time for me to tell him that I had not participated to that extent. The result was that he inquired when I came to Washington and what I was interested in, and within less than twenty minutes, the particular bill in question was withdrawn from the files and the accompanying letter written. It was promptly returned to the Surgeon General by special messenger. We had been working hard for two days to accomplish this. Unfortunately, however, an outstanding member of the Dental Corps was in Washington the following day and was called in by the Surgeon General to discuss this legislation. The enthusiasm of this member, who thought he was assisting us by placing a high estimate on the benefits of this legislation, if enacted, convinced the Surgeon General that the expenditure involved was greater than it was possible to undertake at that time, and, therefore, he did not approve it as had been tentatively arranged and our proposed legislation was not enacted that year. In fact, little constructive progress was made until 1916.

ARMY DENTAL CORPS LEGISLATION

Soon after my election as President of the National Dental Association, July 10, 1913, the members of the Army Dental Corps, of which there were two factions, began to present their different views for increased legislation. At that time, there were thirty-six first lieutenants and thirty-nine acting dental surgeons in this corps, and all of these were interested in improving their status; but they were about equally divided as to what was the best course to follow.

After each group had submitted a solution of the problem, with an appeal for endorsement and recommendation in my President's address, I carefully studied all these data and outlined a definite policy and submitted it with a specific statement that if this was acceptable to both groups, I would sponsor it with the hope of securing its approval at the Rochester meeting in 1914. After the usual preliminaries in such matters, my proposition was agreed on. My recommendation was as follows:

It is not necessary to present any argument with reference to the need of the Army Dental Corps or the services it is rendering. However, I think there is no question that the status of this corps is not in keeping with that of other corps or such as to render military prestige to its members or reflect credit upon our profession. In military life rank counts for much and while there has been considerable effort in the last few years to improve this condition, yet I am of the opinion that if our reorganized National Dental Association endorse a strong but fair policy, and loyally support this, there will be no question that the desired legislation will be enacted at some early date.

During the last year a Bill was introduced giving recognition to the Veterinary Corps far in advance of that now given to the Dental Corps. We have no disposition to oppose the veterinarians securing this recognition, yet we cannot help but feel that it would mean the lowering of the dignity of our profession and work a distinct disadvantage to the efficiency of the Army Dental Corps if it does not receive equal recognition. Therefore, I would recommend that a Dental Reserve Corps be created. Also, that there be provision for one Colonel in the Dental Corps; not more than 25 per cent of the corps should be eligible to Majorship, and only then after ten years service; a stipulated per cent as Captains and the remainder as First Lieutenants.

Rank regulates both increased pay and position and in order that the service be developed to its highest possible efficiency it is to be hoped that the Surgeon General of the Army will appreciate the need for such legislation and give it his approval. What applies to the Army Dental Corps should apply alike to the Navy Dental Corps.

This recommendation was unanimously approved by the reference committees on the President's address and legislation, of which L. L. Barber was a member of the former and the late A. O. Ross a member of the latter; and later by the House of Delegates. I had selected the Reference Committee on Legislation with considerable care and with the thought that the members would become familiar with the dental situation in both the Army and the Navy, and with the further thought that they would probably be selected as the new Committee on Dental Legislation, and I so recommended them to the Board of Trustees. However, there immediately developed a sentiment that I serve on this committee in order to further my recommendation, but I offered a number of objections to this, one of which was the fact that I was the retiring President and had already sacrificed too much time from my practice. Another was that I would not consider taking the place for which I had recommended Dr. Ross, as I assumed that they would not elect two members from the same city. The facts are they overpersuaded me and readily agreed to have both Dr. Ross and me serve on this committee, and it was stipulated that I should serve as

chairman. I have often thought that this was most unfortunate so far as I was personally concerned, since it has called for so much sacrifice in time and energy, and the incident neglect of an active practice with its associated financial sacrifices.

On the other hand, there have been some peculiar combinations which no doubt largely contributed to our outstanding legislative success of Oct. 6, 1917, and I seriously question whether if this peculiar combination had not existed, favorable legislation would have been enacted, either then or at any subsequent time up to the present. The combination was this: My long time friend, L. L. Barber of Toledo was President of the National Dental Association; I was chairman of the Committee on Dental Legislation; the Hon. Newton D. Baker of Cleveland was Secretary of War and Senator Atlee Pomerene of Canton was a recognized leader of the majority political party in the Senate. It so happened that another Ohio man was Comptroller of the Treasury, and he was a contributing factor in securing the recognition of all service when computing length of service for promotion, which decision was rendered in 1916.

After the Rochester meeting, I had some serious trouble with my eyes as the result of overwork during the year and, after returning to my office, I spent some time in developing the plans for our legislative campaign. When Congress assembled in 1915, we aggressively took up this work, and with the enactment of the National Defense Act, June 3, 1916, we were able to secure a decided increase in status for these dental officers. This legislation provided for the ranks up to and including major, but it required twenty years of service to reach a majority. The question of determining what service should be counted in computing length of service for promotion first brought a ruling from the Judge Advocate General that this was limited to commissioned service. This we protested, and a second but similar decision was rendered. Senator Atlee Pomerene had become convinced of the justice of counting all service, and he and I had taken the matter up directly with Secretary Baker, who then referred this question to the Comptroller of the Treasury, as there was a question of money involved, and a decision was promptly rendered construing the word "service" in its broadest sense, which recognized all service, whether it was as a contract dental surgeon, acting dental surgeon or as a commissioned officer in the dental corps.

During the discussion relating to recognizing noncommissioned service in the Senate, it was stated that this was more than had been provided for the medical officers of the Army, and more than one Senator expressed himself as willing to grant the dental officers everything that was provided for the medical officers, but they objected to this at that time because it had never been granted the medical officers. These statements encouraged those active in securing a better status for our representatives in the Army to seek further legislation and place the dental officers on an equal status with the medical officers. Therefore, April 9, 1917, we were able to secure the approval of General Gorgas, the Surgeon General of the Army, of legislation creating a status for dental officers equal with that of the medical officers. At the time this was agreed on, I left copies of the proposed amendment with Senator Atlee Pomerene and Emory A. Bryant. The understanding reached between General Gorgas and me was that this equal status legislation would be introduced at the first favorable opportunity, but some time

elapsed before that opportunity developed.

In the meantime, the World War situation was becoming more acute, and the Medical Department of the Army was quite active in developing an adequate Medical Corps. To that end, Congressman Hubert Dent of Montgomery, Ala., who was chairman of the House Military Affairs Committee, introduced an emergency bill, H.B. 4897, in the House, June 25, 1917, which, while brief, eliminated for the time being the length of service required of certain medical officers for promotion. This legislative proposal made possible the immediate promotion of a very large percentage of medical officers and also the direct commissioning of other officers in the grades as high as major. Lieut. Benjamin C. Warfield, a graduate of the Dental College, Ohio State University, was stationed at the Columbus Barracks at that time, together with Capt. Seibert D. Boak. Captain Boak was away at the time, but Lieutenant Warfield received a copy of the *Army and Navy Journal* on Sunday morning and found therein a reference to Congressman Dent's emergency medical legislation. He promptly got in touch with me; we reviewed the situation, and I decided that this was the opportune time to introduce our equal status Dental Corps amendment. However, I endeavored first to get L. L. Barber, Otto U. King and William H. G. Logan, by phone, but was unable to reach any of these gentlemen during the afternoon or up to midnight that night, at which time I sent telegrams to Senator Pomerene and Dr. Bryant, calling their attention to the developments and authorizing them to take such steps as would be necessary to protect our interests. Senator Pomerene was not in Washington at the time and Sen. Henry Cabot Lodge introduced our amendment. Therefore, this became known as the "Lodge dental amendment," and we promoted this with all the vigor and support at our command; but it is a regrettable fact that there was some very strong opposition coming from a source which made it most discouraging, and this was followed by requests and demands that our amendment be withdrawn. It was later reported that prior to the introduction of our amendment, some tentative arrangements had been made for the introduction of a general Medical Department bill. This was supposed to provide a better status for the Medical Corps, the Dental Corps, the Veterinary Corps and the Nurses Corps, and no doubt it contemplated increases for all; but I never was privileged to see a copy of this proposed legislation; in fact, I have always questioned whether it had ever been definitely drafted.

Maj. William H. G. Logan, holding a commission in the Medical Corps and in charge of the Dental Corps activities, had approved of this proposed general Medical Department legislation about two weeks prior to the introduction of our amendment, but, unfortunately, the chairman of the Committee on Dental Legislation was not advised regarding this arrangement. I later ascertained that a few others were informed that there were some things developing along this line, but they were requested to treat the matter confidentially. Had I known of this arrangement, our amendment would probably not have been introduced, at least until I could have secured more information regarding the details of the proposed general legislation. However, after this was introduced and our friends in the Senate, members of the profession generally and the members of both the Army and the Navy Dental Corps were

loyally supporting us, I could see no reason why the regularly authorized committee and all other interests mentioned should be embarrassed on account of this unfortunate development, for which we were in no way responsible.

In this connection, I quote the following from our legislative report submitted at the New York meeting in October, 1917:

> Then some unfortunate complications developed, but for the time being they were seemingly fairly well adjusted. Your chairman promptly prepared a letter to be sent out in circular form to some two thousand of our members in various parts of the country. This was sent out by your general secretary, who also enclosed a strong circular letter. These letters presented the situation and requested prompt cooperation in behalf of the Lodge amendment. The response was all that could be expected but soon after this campaign began to show results some of the heretofore complications, together with a considerably increased pressure for the withdrawal of our amendment, again developed, until we were left confronted with two distinct problems either of which presented embarrassing angles. First, withdraw our amendment and thus satisfy some of our friends and well-wishers out of Congress and hope for their cooperative support in securing justice in the future, in either combined or individual legislation. Second, stick to our original plans, since matters not necessary to mention here fully satisfied your chairman that he was not responsible for the embarrassing complications, if such they were. Of the two courses open, we chose the latter, even though the probabilities of more personal criticism would result from this decision, especially in the event of failure. By taking the other course we would have necessarily admitted to our friends in Congress that our position was not well grounded, thus greatly embarrassing any future efforts; while our decision to "stand pat" did not give those anxious for our withdrawal an opportunity to question the sincerity of our statements relative to our strength in Congress. From many and various sources we were constantly reminded of the certain failure that awaited us, and we are willing to admit that success never seemed so uncertain as during the last two weeks of Congress, except the two last days.

On the other hand, as time passed, many of my professional friends insisted that unless we withdrew this amendment, we would greatly handicap the dental profession, and some contended that we would put dentistry back fifty years because of incurring the unnecessary antagonism of the medical profession. Many of the outstanding members in the profession and some of my close friends were of the opinion that I was too obstinate when I would not consent to the withdrawal and, had it not been for the fact that L. L. Barber, as President, and the other Ohio connections which have heretofore been mentioned, supported strongly by Otto U. King, Emory A. Bryant and the members of the Army Dental Corps, I seriously doubt that I or anyone else could have withstood the pressure brought on me for the withdrawal of our amendment. Owing to certain developments, we were quite anxious to make a slight change or two in our amendment, but as General Gorgas had endorsed all its provisions, we felt it best to make not even the slightest change, until a peculiar situation developed about two weeks before Congress adjourned.

Senator Lodge was an outstanding Republican member of the Senate, and he and Senator Pomerene had worked in the closest harmony in this legislation, but as he was a member of the minority party and Congress had been in session for many months, and as he was not in good physical condition, he left for home about two weeks before adjournment and turned his amendment over to Senator Pomerene. This gave us our opportunity to make the few changes we had in mind, and thereafter it became known as the "Pomerene modified dental amendment."

Understand that during all this time H.B. 4897, to which our amendment had been offered, had been held up in the Senate Military Affairs Committee, even though this was an emergency matter and was supposed to have been passed in a very few days' time. But about three days before Congress adjourned, the Committee, in the absence of some of our friends, was able to report this bill out without our amendment attached thereto. When this came up for consideration, Senator Pomerene requested that it be passed until the following day, as he had an amendment to offer but did not have the data with him at the time. The following day, the bill, together with our amendment, was passed and went to the House for concurrence. Everything broke exceptionally favorably for us and was concurred in by the House, as one of its last acts, and signed by the President as the last bill before Congress adjourned Oct. 6, 1917.

As a matter of comparison, instead of the thirty-six first lieutenants and thirty-nine acting dental surgeons which we had at the time of our 1914 meeting, we now have seven colonels, eight lieutenant colonels, forty-one majors, ninety-nine captains and two lieutenants, a total of 157, as of Jan. 1, 1929. In addition to this, there are at the present time approximately 5,000 dental reserve officers, in the different grades, and it is gratifying to state that our equal status legislation provided the necessary authority for the organization of the Dental Reserve Corps, notwithstanding it was contended by some in high authority that we had not secured anything for the officers of the Dental Reserve Corps.

In addition to the fortunate Ohio combination heretofore mentioned, it is interesting to note that when our original committee of five members was elected in 1914, there were two members from Ohio, A. O. Ross and I, and there are two Ohio members on this committee at the present time, Frank M. Casto and I. In the meantime, L. L. Barber served as a member for ten years, and thus for several years there were three Ohio members on this Committee. In addition to this, Clyde M. Gearhart, formerly of Ohio, served as a member for seven or eight years. Herbert L. Wheeler, one of the original five members elected in 1914, served until the time of his death, March 23, 1929.

NAVY DENTAL CORPS LEGISLATION

At the next session of Congress, we put forth every effort to enact similar legislation for the Navy Dental Corps and succeeded in everything except the securing of actual rank in the two higher grades. The Navy Department objected to granting actual rank in these grades, as they contended a situation might arise where a dental officer, because of his rank if provided, would necessarily have to be placed in command of a hospital or other ship. This legislation repealed all the laws relating to the Medical and Dental Reserve Corps and transferred such reserve officers to the Naval Reserve Force. It provided that the officers in the Navy Dental Corps were eligible for advancement in grade and rank in the same manner and under the same conditions as officers of the Navy Medical Corps up to the rank of lieutenant commander, which corresponds to major in the Army. It further provided that a definite percentage of these dental officers were eligible to the pay and allowance of commander and captain, but were not granted the actual rank. Commander and captain in the Navy corresponds to lieutenant colonel and colonel in the Army. This legislation was approved by

the President, July 1, 1918, and became effective on that date.

EXCISE TAX ON GOLD

During the period of the World War and soon thereafter, the American Mining Association attempted to enact legislation, on two different occasions, providing for an excise tax on gold which would have greatly increased the cost of the gold used in the practice of dentistry. We vigorously opposed this legislation, and whether or not we had any influence on the results, it is sufficient to say that this legislative proposal was never enacted into the law.

TARIFF LEGISLATION

Immediately after the presidential election in 1920, the question of a new revenue bill was taken up for consideration, and practically every manufacturer, regardless of h's product, started a vigorous campaign to have the tariff duties greatly increased. The dental manufacturers were contending for increases ranging variously from 75 to 300 per cent. Heretofore, the average duty had been between 20 and 25 per cent, but after considerable correspondence, a conference was held in Cleveland with representatives from the American Dental Association and the American Dental Trade Association present. This conference lasted throughout the day, and we finally compromised on a 35 per cent ad valorem duty as being an equitable adjustment. Be it said to the credit of some of the manufacturers present that they kept their agreement, but, on the other hand, there were some present, and many others who were not, who did everything possible to defeat the arrangement agreed on.

We appreciated the fact in the beginning that there was a distinct difference between the manufacturing of surgical and dental instruments, as the surgical instrument industry in this country was of recent origin; that is, it was largely developed during the World War, and because of necessity. On the other hand, the dental instrument industry, like the American dental profession, had long been recognized as preeminent throughout the world. The best evidence of this, and that there was no occasion for any high rate of duty, was the fact that our exports exceeded our imports 20 to 1. This fight started in 1920, when the preliminary work was begun, and ended with the enactment of the revenue bill in 1922, with a 35 per cent ad valorem duty placed on dental instruments and 45 per cent on surgical instruments. We endeavored not to become involved in any way with the surgical instrument problem because of the difference in the industries, and, for that reason, we advocated a separate classification for dental instruments; but as surgical and dental instruments had never been individually or collectively classified heretofore, Congress may have thought that they went far enough in placing both of these in one paragraph, 359.

Our hardest fight in this connection was to secure a lower rate than was placed on surgical instruments, and many contended that it was quite impossible to differentiate between the two. It became necessary for me to make a hurried special trip to Washington to confer with Senator McCumber, the chairman of the Finance Committee, and Senator Smoot, a member of the committee, who was our outstanding opponent for a lower rate of duty. It developed, in my first conference with Senator Smoot, that some of the appraisers had informed him that it was impossible to differentiate between the two classes of instruments, and he asked my opinion with reference to this.

I answered by stating that if this was the situation, it was the best possible evidence that they needed some new appraisers. He then informed me that he had a large roll of combined surgical and dental instruments at his home, which had been submitted to their committee to demonstrate to them the impossibility of placing two separate rates on these instruments, and requested that I return the following morning, when he would bring this down for my inspection. Naturally, I experienced twenty-four hours of uncertainty, as I appreciated the fact that this was a "stacked deck," so to speak, prepared for a special purpose, and I made up my mind that this would be no time for me to hesitate in making a definite answer in classifying the instruments inspected. After I had identified a number of instruments, the Senator handed me one that was applicable in either case, and he seemed to think that my admission to that effect was a strong point in support of his position; but I promptly stated that, in such cases, the higher rate would prevail and he agreed that such would be the result. Senator Smoot finally said that he would call in the chief appraiser from New York, and if he would concur in my statements, he would withdraw his objections, and the act was passed as we had advocated, except as relates to a separate classification.

CONGRESSIONAL APPROPRIATION FOR COOPERATIVE RESEARCH

Both as a legislative and a research proposition, we advocated an appropriation by Congress for our cooperative research work at the National Bureau of Standards. S. W. Foster, as President of the American Dental Association, L. L. Barber and I appeared before Secretary Hoover of the Department of Commerce, in order to secure his approval of our contemplated cooperative research program as this bureau was under his department. My associates decreed that I should present our case and as Mr. Hoover is now President, you no doubt will be interested in knowing that he soon evidenced a sympathetic attitude toward the proposed cooperative research work at the Bureau and made some very constructive and helpful suggestions regarding our procedure.

UNITED STATES PUBLIC HEALTH SERVICE AND NATIONAL INSTITUTE OF HEALTH

One of the most important legislative problems that we have been interested in during the past two or three years related to the United States Public Health Service. This was fully reviewed in the 1928 report of our committee presented at Minneapolis. We were quite active in this legislation and were keenly disappointed when President Coolidge vetoed it after it had passed Congress without a vote recorded against it. We have also been supporting a bill introduced by Sen. Joseph E. Ransdell, of Louisiana, providing for the establishing of a national institute of health. This bill passed the Senate recently, but was amended in the House and died with the adjournment of Congress, March 4, 1929.

DEDUCTION OF TRAVELING EXPENSES AND NARCOTIC TAX

We collaborated with the American Medical Association and other professional groups in an effort to secure legislation which would permit of deducting traveling expenses while attending professional meetings. In this connection, I feel justified in stating that I have always contended that this is a matter of regulation rather than legislation. A recent

decision by the United States Board of Tax Appeals overruled the regulations of the Department and these deductions are now permitted.[1]

A few years ago, we cooperated with others in having the narcotic tax reduced from $3 to $1, and again last year we opposed the increase of this tax back to $3. It may be a matter of interest to know that these two problems developed so suddenly, through an adverse report by the Senate Finance Committee, that our telegraph bill for the month of May, 1928, was $136.03. In addition to wiring a strong appeal for one and a like protest against the other to every Senator, we also wired the officers of the various state dental societies to support our action by wiring their two Senators. The Senate passed the one that we were supporting by a vote of 59 to 13, but this failed in the Conference Committee, since it was a Senate amendment and the House members failed to concur. The other measure was defeated by an overwhelming vote, but this did not go to the Conference Committee as it was a Senate amendment to a House bill.

SPIRITOUS LIQUORS

Our long time friend and general agitator, W. I. Jones, has written letters and published articles criticizing the Committee on Dental Legislation in particular and the dental profession and others in general. He has stressed the fact that our committee "was asleep at the switch" when the Volstead Act was passed by Congress, and thus the dentist was not granted equal authority with the physician in prescribing spiritous liquors. For your information, and as a matter of record: I resigned from this committee at the 1918 meeting, in order to take up some more active war work, but was again elected at the 1919 meeting, over my vigorous protest. Therefore, I have what should be an acceptable alibi, as the Volstead Act was passed between the time of my resignation in 1918 and my election in 1919. However, I am frank to state that I seriously doubt that any committee or the united dental profession could have convinced Congress that dentists should be authorized to prescribe spiritous liquors, as is provided for physicians. On the other hand, I strongly contend that a dentist should be permitted to obtain, under a permit similar to that governing the purchase of alcohol, a specified amount of such liquors for direct administration in his practice. Further, I had arranged with the Commissioner of Prohibition to have the regulations modified to that extent, provided the American Dental Association took some definite action approving of this modification. This matter had never been submitted to a direct vote of the House of Delegates until the Detroit meeting in 1927, and the vote was 61 in favor and 65 against it. Therefore, the question was not further discussed with the Prohibition Department. In spite of the fact that I have fought for equal recognition for our profession, in this instance I seriously question the advisability of dentists being authorized to write prescriptions for such liquors and, in my opinion, the occasion would seldom arise when this was necessary.

NARCOTIC TAX REGULATION

Clyde M. Gearhart and I took part in a full day's session held in Washington in 1927, at which time the regulations relating to the Harrison Narcotic Act were redrafted. The results of this con-

1. Important Information Relating to Deducting Traveling Expenses When Filing Income Tax Reports, J. A. D. A., Miscellany, 16:572 (March) 1929.

ference removed a number of technical and burdensome restrictions, especially those relating to keeping records, etc. In this connection, there is a plan under consideration at this time for formulating a uniform state law relating to the control and supervision of narcotic drugs, and we have been called on to look after the interests of the dental profession in this matter. In a communication received last week, it was stated that the most important recommendation which I had made would be granted, i. e., that the rights of the dentist be made to harmonize with the provision of the Harrison Narcotic Act.

DENTAL DEGREES IN GREAT BRITIAN

The British Parliament enacted legislation in 1921 which proved quite embarrassing to dentists with American degrees practicing in Great Britian, as they are not permitted to use the dental degree or in any way indicate that they are dentists. A number of our dentist friends in London took this matter up with several of us about two years ago, when we were in London, and the matter was thoroughly and carefully reviewed. While there, Drs. Barber, Volland, Conzett and I held a conference with Counselor Ray Atherton at the American Embassy, and since then we have held several conferences with Secretary Kellogg and others of the Department of State in Washington, regarding this unfortunate situation. You understand that anything of this nature requires careful and diplomatic handling and that all international matters, especially concerning England, require much deliberation in order to accomplish results. However, we have reported on this subject, on two different occasions, to the American Dental Association and we feel justified in saying that some progress has been made.

THE SIXTH INTERNATIONAL DENTAL CONGRESS

The Sixth International Dental Congress was held in London in August, 1914; in fact, they were in session at the time of the declaration of war, which practically caused a cessation of their activities. Under date of April 30, 1914, as President of the National Dental Association, I wrote to the Hon. William Jennings, Bryan, Secretary of State, requesting that he accept the invitation extended by Great Britian to participate in this International Dental Congress. I quote one paragraph from my letter to the Secretary, as follows:

> Our Association has recently been reorganized and has a membership of approximately fifteen thousand (15,000), and if you can grant our request and permit me the privilege, I will gladly furnish you a list of fifteen names of our prominent members who are planning to attend, and who will reflect credit to our Government and our profession. Or, I can supply you with a partial list as you may desire to recognize your family dentist and possibly others. Of course, we appreciate that such delegates are to bear their own expenses.

Secretary Bryan promptly advised that before this invitation could be accepted, Congress must specifically authorize such action, and immediately after this, I received a telegram that a joint resolution had been introduced by Senator McLean, several weeks previously, authorizing the acceptance of this invitation and appointing one delegate, who had been definitely decided on.

Therefore, in view of developments I promptly wired Senators Pomerene and Burton regarding the situation, briefly stating my recommendations and advising that further details would follow by letter. The resolution came up for consideration by the committee the day my telegrams were received, and at the request of the Ohio Senators, action was postponed for one week, when it was

amended as I had recommended and was promptly passed by the Senate. When it reached the House, a number of unexpected delays occurred. For instance, one member of Congress was very positively opposed to the acceptance of these invitations to international congresses, and he controlled the situation for some time, as unanimous consent had to be secured before the joint resolution could be considered. The late Clement Brumbaugh, who served in Congress from the Columbus district for a number of years, finally was able to arrange with the opposing Congressman to be absent at a time when the Speaker had consented to recognize him to present this joint resolution. The Hon. Champ Clark was the Speaker at the time. Incidentally, his father had been a dentist, and I had personally conferred with him regarding the importance of this particular resolution. This was finally enacted at the time of the meeting of the National Association in Rochester, N. Y., July 7-10, 1914. I later received a telegram from Secretary Bryan advising that only twelve of the persons that I had recommended could be appointed, as three others had been agreed on prior to the submission of my list.

My only reason for assuming entire charge of this legislation, rather than referring it to the Committee on Dental Legislation, was that I had taken this up as an executive proposition, and it developed so suddenly that time did not permit of any delay. The Committee was kept advised of its progress from time to time.

INCREASED PERSONNEL OF THE ARMY AND NAVY DENTAL CORPS

Late in the last session of Congress, a general Medical Department bill was introduced, which provided for a decided increase in the personnel of the Army Dental Corps. The American Dental Association has approved of such legislation as well as similar increases for the Navy Dental Corps, as it is generally conceded that one dentist cannot render efficient service for more than 500 or 600 persons in either the Army or the Navy, and both these Corps are established on a basis of approximately 1 to 1,000 of the enlisted strength of the Army and the Navy. This legislative proposal, together with that creating a national institute of health and proper recognition for the discoverers of anesthesia will probably be introduced at this special session of Congress. But it should be understood that there is no probability that any of this legislation can be passed at the special session, and the only thing to be gained by such introduction is in an educational way.

RECOGNITION FOR THE DISCOVERERS OF ANESTHESIA

Our committee has given considerable time and effort relating to appropriate recognition for the discoverers of anesthesia; that is, Horace Wells, as the discoverer of nitrous oxid anesthesia and William T. G. Morton, as the discoverer of suphuric ether anesthesia. We hope to be able to convince Congress that an adequate appropriation should be made to erect memorials in recognition of the great humanitarian services of these two dentists. They should be thus recognized for making two of the greatest, if not the greatest, discoveries for the benefit of afflicted humanity in the history of the world.

PENDING LEGISLATION

Several months ago, the Committee on Ways and Means of the House started holding hearings in order to secure specific data as a basis for amending the pres-

ent revenue act. Practically every industry presented arguments for increased tariff duties, and again a strong demand was made for increasing the rates on surgical and dental instruments, as well as scientific apparatus. In opposition to this, we are presenting similiar arguments to those used in 1921 and 1922, and for specific data I refer you to the April issue of THE JOURNAL.[2] When this tariff legislation is satisfactorily adjusted and the other legislative proposals herein mentioned are enacted into law, it would seem that considerable progress has been made even though this covers a period of thirty years of interest in state legislation and fifteen years of congressional activity.

EXPENSE INCIDENT TO LEGISLATION

If time had permitted, I should have endeavored to secure from the records in the American Dental Association the expenses incident to our legislation in Congress since 1914. In explanation, I will say that I was first invited to present this paper at the May meeting, but very recently the chairman of your Program Committee advised me that the essayist for the April meeting could not be present, and I agreed, on short notice, to being advanced one month and I may yet secure and append this information. However, I am quite confident that the expense has been only nominal and, in this connection, I am reminded of a discussion with J. H. J. Upham last week when legislation was being reviewed. Dr. Upham has been chairman of the Legislative Committee of the Ohio State Medical Association for the past fifteen years and has been a trustee of the American Medical Association for several years. He stated that the annual budget for legislation of the American Medical Association was in excess of $28,000. Compared with this, my estimate of our entire expense for the past fifteen years will not total one-half of the annual appropriation of the American Medical Association and, further, I do not believe that there has been any single professional group that has secured so much favorable federal legislation in the past fifteen years as has the dental profession.

ACTIVITIES OF THE SCIENTIFIC FOUNDATION AND RESEARCH COMMISSION

The first record that I find of a committee on scientific research, in the National Dental Association Proceedings, was in 1907, with Henry C. Ferris, of Brooklyn, as chairman. Dr. Ferris continued as chairman until the 1912 meeting. In the meantime, John R. Callahan, Levitt E. Custer and Harry M. Semans served as members of this committee from Ohio; Dr. Semans serving in 1911 and 1912. All these men were appointed during the time I was Secretary.

For data relating to the next development in research activities, I quote the following from the minutes of the Executive Council of the National Dental Association under date of Sept. 12, 1912.

Dr. C. M. McCauley addressed the Council as a representative from Section 1 regarding a Research fund for investigation. After some discussion he was authorized to confer with Dr. Weston A. Price, Chairman of Section 1, and to report later. The following day's records show that "Dr. Weston A. Price addressed the Council relative to the advisability of investigating the possibilities of securing our support or cooperation in doing certain experimental and research work. On motion Drs. Weston A. Price, Arthur R. Melendy and C. M. McCauley were appointed a special Committee to investigate and report at the next meeting."

2. Important Data with Reference to a Proposed Increase in Tariff Duties on Dental Instruments, J. A. D. A., Miscellany, 16:762-763 (April) 1929.

At the first general session of the National Dental Association meeting, held at Kansas City, July 8, 1913, Dr. Price, as chairman, made a detailed report, which can be reviewed on pages 6 to 10 of the 1913 Proceedings. This report was unanimously adopted and the Association made provision in its new Constitution and By-Laws for the creation and operation of the Scientific Foundation and Research Commission, and it has been functioning since then. June 28, 1915, the Research Institute of the National Dental Association was incorporated under the laws of the State of Ohio, with the following incorporators, in the order named: George W. Crile, Homer C. Brown, E. A. Petrequin, H. J. Crawford and Weston A. Price. Dr. Crile, as you know, is an internationally known surgeon, Mr. Crawford, a prominent attorney, and Mr. Petrequin, a well-known business man; all of Cleveland. The following trustees were subsequently elected: Weston A. Price, Thomas P. Hinman, Clarence J. Grieves, Edward A. Petrequin, John V. Conzett, Eugene R. Warner, Harry J. Crawford, George W. Crile and Homer C. Brown. The trustees organized by electing Dr. Price chairman, and soon thereafter they purchased property located at 8803 Euclid Avenue, the fee of which is still in the name of the American Dental Association, but which is under a ninety-nine year lease. Under this original ninety-nine year lease, the total amount of rent accruing therefrom, over this period, would have amounted to more than $1,100,000.00, and it was provided that all of this was to be spent on dental research. However, owing to a depressing real estate market in the Euclid Avenue district, it was necessary to modify this lease somewhat, but only as relates to the income, as all of this must be used in the manner indicated.

The research spirit of the dental profession was very largely stimulated by the enthusiasm and interest taken by Weston A. Price, who served as chairman of the Scientific Foundation and Research Commission from 1913 to 1919. He has been most magnanimous with his time and funds and has appeared before many dental and other organizations and deeply interested all who have heard him. At the time the Research Institute was incorporated in Ohio in 1914, all the trustees contributed to a fund which was our initial payment on the property purchased. In addition to this, at the next meeting of the Ohio State Dental Society, the board of directors voted to contribute $4,000, as I recall it, to this building fund, and a number of John R. Callahan's friends purchased him a complete and expensive x-ray equipment with the understanding that this was to go to the Research Institute at his death. Also, a number of Ohio dentists and others contributed annually to this work for a five-year period prior to the time when some of the state dental societies adopted the plan of collecting $1 additional dues for research. Further, Gillette Hayden made a valuable contribution of specially prepared skulls to the Research Institute. Therefore, it is an outstanding fact that the early activities and support of dental research is largely of Ohio origin, and at present we have three members on the commission of twenty-five, as follows: Weston A. Price, L. L. Barber and Homer C. Brown. Dr. Barber and I are members of the executive board and I am secretary of both the executive board and the Scientific Foundation and Research Commission. I have been on the commission since it was established and on the

executive board for the past ten years, first as vice chairman and later as secretary. Frank O. Hetrick, of Ottawa, Kan., has been chairman of the commission and the board since 1919.

During only a part of this time have we been appropriating any funds for research work in Ohio; but for the past two years we have been making a limited grant to the Western Reserve University. Harry M. Semans and I have discussed this problem, and it was understood that until they had a research worker and an acceptable problem at the College of Dentistry, Ohio State University, they would not make application for a grant; but recent developments have been such that we have an application on file, even though it was received somewhat later than our requirements stipulate.

For your information, I will state that the executive board first reviews these applications and, after being tentatively approved, our present plan is to have them carefully checked by a special committee of the National Research Council. They are then taken up and considered by the full commission at the annual meeting of the American Dental Association and then approved by the budget committee of the Trustees, the Trustees and the House of Delegates, in the order named. The following are the grants appropriated for 1928-1929, together with the problems for investigation:

1. University of Minnesota, $3,000; principally bacteriology.

2. Forsyth Dental Infirmary, $3,500; pathology and diet.

3. Northwestern University Dental School, $3,000; histology and chemistry.

4. University of California, $3,500; diet, metallurgy and pyorrhea.

5. University of Louisville, $1,500; histology, pathology and biology.

6. Texas Dental Society, $750; mottled enamel.

7. University of Michigan, $2,000; bacteriology and root canal technic.

8. Western Reserve University, $1,200; histologic development of the enamel organs.

9. University of Southern California; paleodontology.

10. Johns Hopkins University, $1,800; swine feeding experiment, Bureau of Animal Industry at the United States Department of Agriculture.

11. The National Bureau of Standards, $7,500; cooperative metallurgic and allied problems.

STANDARDIZING DENTAL PROPRIETARY PREPARATIONS

The question of making some attempt at standardizing dental proprietary preparations had been discussed by various groups for some time, but, in 1925, the California State Dental Association passed a resolution recommending that the American Dental Association take some action regarding this problem. The Trustees referred this resolution to the Scientific Foundation and Research Commission, and the following committee was appointed: Harry E. Kelsey, M. D. Huff and Homer C. Brown. Having been named as chairman of this committee, I called attention to the fact that there was a possibility of some financial complication developing in addition to the necessary expense connected with such investigations, and for that reason I suggested that a like number from the Board of Trustees, who have charge of the financial affairs of the Association, be appointed. This was concurred in, and I was requested to take the matter up with the Trustees, which resulted in the appointment of a special committee of five, Mark F. Finlay and Arthur B.

Crane, being added to the original committee. Dr. Crane declined to serve, and L. L. Barber was later appointed by President Foster.

This committee studied the question quite carefully and, as chairman, I held a conference with some of the American Medical Association officials, with the thought of developing a cooperative program, which was finally agreed on. Our report presented at the Philadelphia meeting will be found on pages 63 and 64 of the official Transactions of 1926. The motion to approve this report was amended by continuing the committee, with instructions to put the plan in operation at the earliest possible date, but unfortunately some portion of this action was in some way omitted from the official Transactions. The expenses in connection with the Philadelphia meeting were unusually large on account of the International Congress, and the Trustees had advised that they could not supply the necessary funds to start this cooperative investigative work at that time. As an evidence of this financial stringency, it was necessary for all the departments to accept a proportionate reduction from that provided in the approved budget. Our committee also submitted reports at the 1927 and the 1928 meeting. In 1927 we set forth the fact that as the President and Secretary had taken this matter up with the American Medical Association officials, we had simply marked time, as we did not desire in any way to complicate matters. At this meeting, an appropriation was made to put into operation this new and important activity, and some months later, Samuel M. Gordon, Ph.D., a chemist, was employed to carry on this cooperative analytic work in the laboratories of the American Medical Association. Some very important results have been accomplished, and we have every reason to think that this service is going to be quite beneficial.

However, to our surprise, a misleading editorial appeared in the August, 1928, number of THE JOURNAL wherein the credit for the development of this scheme was given to Henry L. Banzhaf, the President of the preceding year. I promptly wrote to Dr. Johnson, the Editor, and set forth the fact that he, as President, had appointed this original committee, which had worked out and recommended the approved plan and, to my further surprise, he informed me that the editorial in question had been written by the chief of the laboratory department of the American Medical Association, under whose directions Dr. Gordon was functioning. I have incorporated the foregoing because of the unusual developments and in order to furnish a brief review of the facts relating to this new and important activity of the American Dental Association.

In conclusion, I feel justified in saying that the various organizational activities herein reviewed have been quite important factors in the advancement and accomplishments of the dental profession, and, further, I have full confidence that the younger members of our profession are going to assume and discharge their responsibilities to the end that all will continue to do their part in every constructive professional advancement which will in any way contribute to the relief of afflicted humanity.

There is a destiny which makes us brothers,
None takes his way alone;
All that we send into the lives of others,
Comes back into our own.

609 Hartman Building.

DIAGNOSIS AND TREATMENT OF POST-EXTRACTION COMPLICATIONS*

By HUGH W. MACMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

OF all surgical procedures, the operation of tooth extraction is perhaps the most universally successful. In spite of an infected field, lack of asepsis and little postoperative care, it is only a very small percentage of cases that cause the least inconvenience.

After the average extraction, the alveolus is cleaned by the flow of blood, which clots, forming a protective plug. The clot rapidly organizes around the periphery of the alveolus into granulation tissue, while the center of the clot breaks down as a slough leaving a wide open drainage tube down through the center of the alveolus. This open drainage is the reason for the great percentage of successes.

The most frequent complication encountered by the oral surgeon is the subperiosteal abscess, which is caused by the presence of pus from the periapical region following the path of least resistance, until, finally emerging from the bone, it is held confined by the periosteal envelop. In extreme cases, the pus may burrow for the entire circumference of the mandible, separating the periosteum from both the internal and the external surfaces. At other times, it may escape from the periosteum to travel long distances along the fascial sheaths.

In the extraction of abscessed teeth, it is well to remember that the infection is located in the tissues beyond the tooth as well as within the root canal. The most important step in the extraction operation is inspection of the alveolus after the removal of the tooth. Whenever the carefully exploring curet passes through the inner or outer bony plate into the subperiosteal region, it should be realized that a subperiosteal infection is already present with all the potentialities of the extreme cases just quoted unless promptly cared for. This care consists simply of incising from within the vestibule of the mouth if the area is located along the external plate, or from the lingual side if the infected area is located along the internal plate. In the region of the mandibular molars, careful inspection should be made of the middle and gingival third of the alveoli, as Black has shown that the pus usually discharges through the bone at these points. It is my practice to make these inspections and incisions, as described, after the extraction of all teeth, whether there is any demonstrable pus present or not.

The many serious complications following unerupted third molar extractions demand an inquiry into the underlying causes and the adoption of a recognized technic which will reduce these untoward results to the minimum. Invariably, the existing cause is the presence of infection under the periosteal flaps, which are raised at the beginning

*Read before the Section on Oral Surgery at the Midwinter Meeting of the Chicago Dental Society, Jan. 15, 1929.

of the operation and too often sutured tightly together at the end.

The recital of a case history will illustrate these points and afford an opportunity to describe some metallic drains which are constructed to suit the individual requirements of cases presenting similar distressing complications.

REPORT OF CASES

CASE 1.—*History.*—April 1, 1925, I. M., aged 26, had a partially erupted lower right third molar extracted by an exodontist, without difficulty. The jaw ached for three or four days, when the face suddenly began to swell. The patient returned to the exodontist, who said that he only extracted teeth and the patient would have to consult a surgeon. A surgeon lanced the swollen area in the inferior buccal sulcus, and the swelling went down. It appeared again in about a week.

April 30, the patient consulted another exodontist, who packed the socket with gauze and incised externally, keeping the external incision open by gauze drains during May, June and July.

August 1, the patient consulted the family physician, who removed the gauze drain and treated him with Alpine lamps and external applications during September, October, November and December.

Jan. 1, 1926, the patient came in with a greatly swollen face. He was very despondent. A Wassermann test was negative. Lateral roentgenographic plates revealed a ragged ulceration of the posterior surface of the right ascending ramus.

Fig. 1.—Buccal and lingual subperiosteal abscesses of dental origin which are not adequately drained after extraction of the tooth.

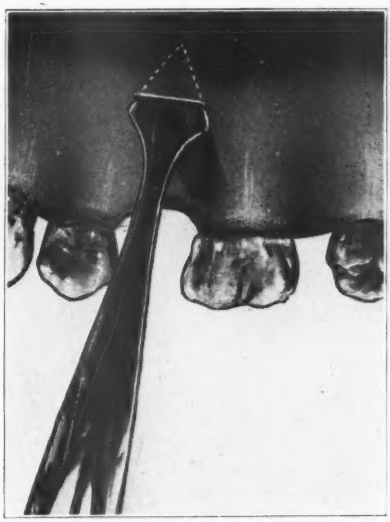

Fig. 2.—Condition calling for drainage. In acute alveolar abscess or whenever curet or exploring instrument passes through buccal or lingual alveolar plate during examination of alveolus, external drainage should be instituted.

Diagnosis.—Localized caries associated with subperiosteal abscess was diagnosed.

Comment.—At the time of the third molar operation, either infective material had been forced under the periosteum or a flap had been raised, which, during the healing process, had locked the infection under the periosteum. Insufficient drainage had defeated the surgeon's attempt. The second exodontist

failed for the same reason, as the abscess had invaded the area under the masseter and had burrowed back to the posterior border of the ramus. Repeated swelling, spontaneous opening and partial drainage characterized the period during which the Alpine lamp was used.

Treatment.—A long incision was made in the inferior buccal fornix, followed by exploration of the sinus tract with Kelly artery forceps, curettement of the posterior border of the ramus intra-orally; firm gauze packing

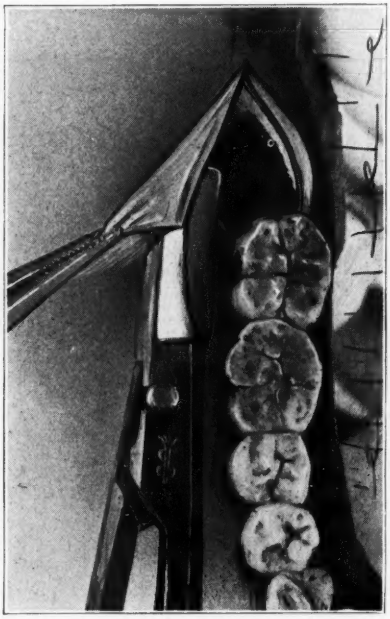

Fig. 3.—Removal of the flap which allows the alveolus of the embedded mandibular third molar to heal with free drainage as does the normal alveolus (see text). Suturing the flap is contrary to the principles of modern surgery.

to hold away muscle from bone, and, on the third day, insertion of a specially constructed drainage tube fastened to the lower molars. The patient wore the appliance from January 13 to February 17, during which time it was reduced in length, width and thickness.

May 29, final roentgenograms show that the posterior border was being restored. The patient has continued well.

Another type of drainage case which, from the number of failures observed, requires special consideration arises in the postoperative treatment of extensive cysts involving the ascending ramus of the mandible. These cysts often destroy almost the entire ramus, hollowing out the condyloid process and obliterating the coronoid. In cases of this kind, the operator's ingenuity is taxed to the limit to correct the condition without depending

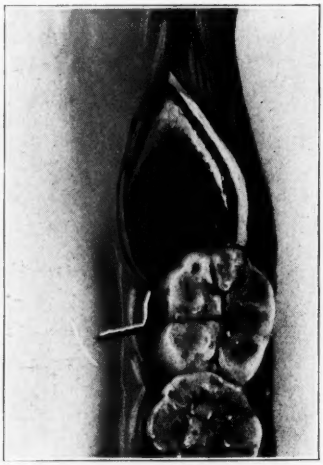

Fig. 4.—"A wound that will drain of itself."

on subsequent operations to maintain drainage on account of the lips of the wound healing before the posterior portion fills in.

Again, a brief history of a case extending over a period of years will serve as a means of analyzing failure after failure and of presenting a method which eliminates all gauze dressings and keeps the opening of the wound patent while the cavity is filling in.

CASE 2.—*History.*—July 14, 1914, Mrs. S. C. F., aged 24, complained of a bad headache and toothache. She consulted a physician and a dentist, who diagnosed a noneruption of a mesio-angular left third molar. The decision was made to extract the second molar and "let the third molar right itself." The patient was taken to the hospital, where the jaws were pried open and the second molar was extracted. The face swelled, and the swollen area was opened externally, July 18. The face intermittently swelled and drained until November 3, when the third molar was extracted under local anesthesia.

Dec. 5, 1914-July 4, 1919, the jaw occasionally swelled and sequestra worked out.

Feb. 23, 1924, there were noticeable popping sounds on working the jaws. The throat was sore and the jaws locked. The patient entered the hospital, February 27, where the jaw was lanced. She left the hospital, March 19. Drainage continued to April 22, when a general surgeon was consulted.

May 5, the patient was operated on by the general surgeon. Daily dressings were applied up to June 14. From 18 to 20 roentgen-ray treatments were given from July 16 to December 11. The jaw apparently healed.

April 7, 1926, the throat began to swell. Pain and swelling were persistent. The swollen gum was opened and drained.

July 3, examination of series of roentgen-ray plates disclosed a large cyst of the ramus, which was found to have been present in 1914.

Diagnosis.—Insufficient drainage was diagnosed.

Treatment.—The area was opened intraorally; the anterior wall of the cyst completely removed, and a metal appliance inserted. Drainage was maintained by the appliance from July 9, 1926, to May 12, 1927. July, 1927, the opening in the retromolar region had completely closed. To January, 1929, the patient has had no recurrence.

Comment.—One drainage failure followed another in this case. The drainage appliances used at the present time are constructed of Melotte's metal. They are inserted a few days after the operation. Some of the larger appliances weigh over a quarter of a pound.

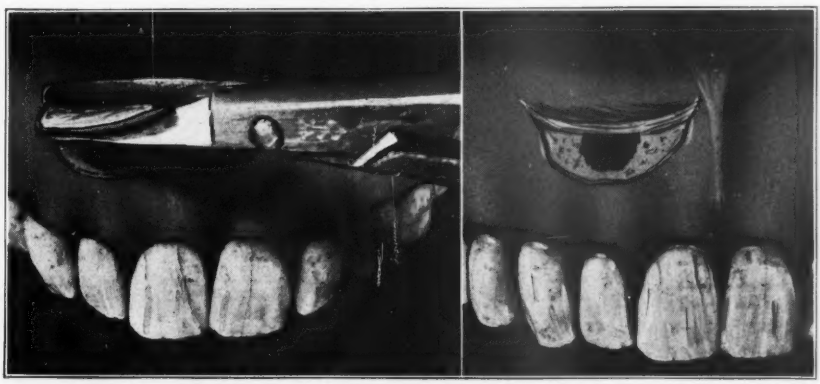

Fig. 5.—Left: Point of flap incised to prevent stoppage of drainage. Right: Wound allowed to heal from the bottom of the cavity as a normal alveolus heals.

In the discussion of postoperative complications, the most important point is prevention. In addition to the inspection and incisions before described, it is my practice to cut back practically all gum flaps in such a manner that a wide gap is left between the flaps, which makes it impossible for the wound to heal other than by filling in from the sides and bottom, and thus creates the condition described before in the healing of the average extraction. Sutures are practically

eliminated. Many incisions are made V-shaped or U-shaped, and the point of the pedicle flap is cut back in order to insure drainage. Whenever the periosteum is raised from the bone in the mandibular third molar region, in addition to the cutting back of the flaps, a small wick of gauze is inserted under the periosteum for twenty-four hours. Aside from this practice, gauze is practically never used for drainage, its only use being to prevent or stop hemorrhage.

CONCLUSION

Not the least advantage of metal drainage appliances is in reducing the number of office postoperative treatments. In the second case cited, over a period of ten months while the drainage appliance was in place, the patient was seen nineteen times. Many of these trips were made voluntarily by the patient on account of anxiety. In another almost identical case under treatment at the present time, the patient has worn a similar appliance for six months without inspection.

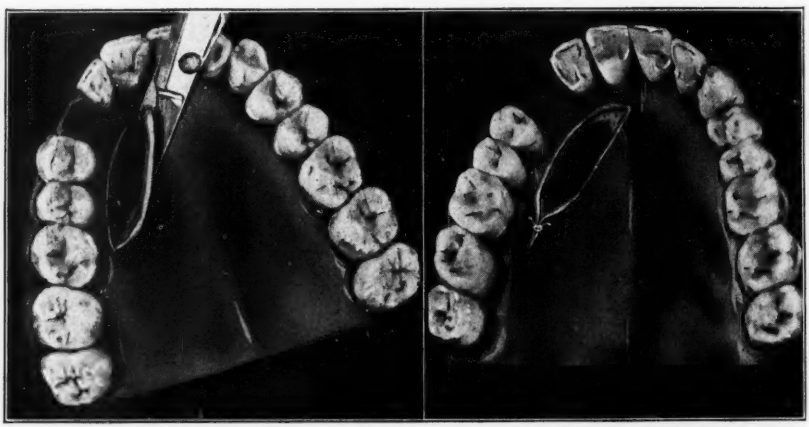

Fig. 6.—Left: Lingual flap cut back to insure adequate drainage. Right: Wound allowed to heal by granulation with no gauze dressings except the first packing to prevent hemorrhage.

DISCUSSION

Charles M. Freeman, Chicago, Ill.: The subject covered by Dr. MacMillan's paper is one that receives altogether too little attention. It is deserving of serious consideration by the general practitioner and the specialist alike. As stated, a large percentage of patients recover normally after extraction of teeth, but this is due to the protective and recuperative mechanism of the tissue rather than to any systematic and well-considered plan of postoperative treatment by the operator. Possibly the best plan of postoperative treatment in most extraction cases is no treatment at all. It is evident in many cases that too much surgical or medical interference delays rather than promotes a rapid and uneventful recovery. While it is, of course, impossible to anticipate and prevent all unpleasant extraction complications, the most important consideration is the prevention rather than the treatment of such conditions. Nearly all operations in the field of minor oral surgery are made necessary because of the presence of infection, with the danger of an acute exacerbation of the infection following surgical interference. Much can be done to prevent this by exercising care and discrimination in selecting the time and method of interference. The extraction of teeth during

the presence of acute infection is usually contraindicated. Dr. MacMillan states that "it is well to remember that the infection is located beyond the tooth." Is it good judgment to extract a tooth for the relief of an acute infection when we are dealing with a subperiosteal abcess or an acute cellulitis of the neck? True, the infection may have had its beginning in the periapical region, but it is no longer confined there, and the trauma induced by the extraction of a tooth at this time may, without compensating advantage, add to the burden already placed on the local tissue resistance. If infection is present about an erupting tooth, particularly the lower third molar, it is much safer to delay the extraction until the infection is under control. Probably irrigation and treatment with local antiseptics will not destroy a large percentage of bacteria present, but such treatment does reduce the infection, and particularly it gives the local tissue an opportunity to develop its resistance and to wall off the infection before the trauma of extraction. A great deal of the postoperative infection following removal of lower third molars can be prevented by preoperative treatment of the local gum infection. The tight suturing of mouth wounds in the lower molar region should never be considered. I must disagree with Dr. MacMillan in recommending the practice of making an instrumental inspection of the socket followed by incision where a buccal or lingual penetration of the bone has occurred. My first reason is that, while Dr. MacMillan may make this examination without trauma, such an exploration in the hands of the operator of even average careful habits would be likely to cause more injury than it could possibly do good. My second reason is that a subperiosteal infection which requires incision should be drained and brought under control before the extraction of the tooth. This last statement should be modified in its clinical application, by the judgment and experience of the operator, as many factors must be considered in determining the procedure. No small factor in postextraction complications is the interference with blood supply due to undue trauma in operation and sometimes to improper methods of introducing a local anesthetic solution, or the use of a solution with too high a content of epinephrin. I would not have you infer from this statement that local anesthesia is contraindicated, for I believe that it is the method of choice in nearly all extractions. When the presence of infection contraindicates the use of local anesthesia, it as definitely contraindicates immediate extraction. A significant point is noted in a case history reported by Dr. MacMillan. "A partially erupted lower third molar was extracted by an exodontist, but when the patient returned four days later with a swelling, the exodontist stated that he only extracted teeth, and the patient would have to consult a surgeon." Such an attitude is scarcely credible and certainly should be whole-heartedly condemned, for no patient can hope for proper care in such a situation. Consultation with some general or oral surgeon with wider experience would be very proper, but a com-

Fig. 7.—Extensive absorption of bone associated with periodontoclasia. The gums are cut back to the edge of the alveolar border after extraction. This method precludes a soft flabby ridge and provides the best possible base for the prosthetic restoration.

plete disavowal of all responsibility for further treatment should unequivocally classify a man as incompetent to extract any tooth. Any comment on the metal drainage appliance would be improper without further opportunity to observe the result from the clinical aspect. In many cyst operations, if the open or Partsch operation is employed, drainage is entirely unnecessary after the first few days as the opening remains sufficiently large, and there has been no disturbance of the major part of the cyst wall, and, consequently, no opportunity for extension of infection. The only necessity is for the removal of any débris from the mouth that may have entered and remained within the epithelial lined cavity. In particular, with cysts of large size, this method has several advantages over enucleation, principally that of the slight disturbance necessary to neighboring tissue, and the few postoperative treatments necessary.

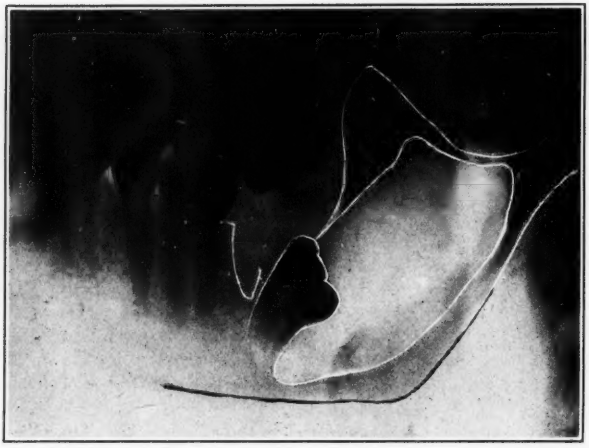

Fig. 8.—Lateral plate, Mrs. S. C. F. (Case 2), July 14, 1914.

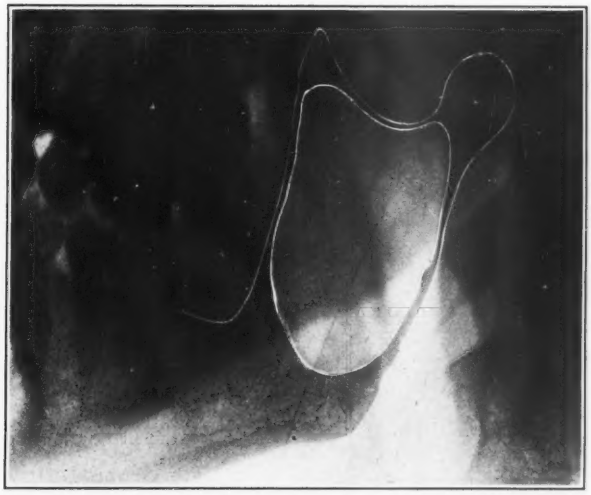

Fig. 9.—Lateral plate, Mrs. S. C. F. (Case 2), Feb. 23, 1924.

Fig. 10.—Lateral plate, Mrs. S. C. F. (Case 2), July 3, 1926.

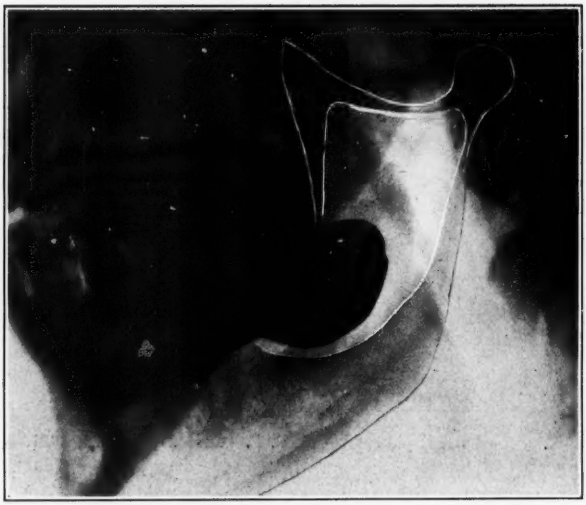

Fig. 11.—Lateral plate, Mrs. S. C. F. (Case 2), showing metal drainage appliance in position.

Fig. 12.—Different types of drainage appliances made of vulcanite, modelling compound, aluminum, and Melottes metal.

FOCAL INFECTIONS IN RELATION TO THE EYE*

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Ga.

STEDMAN'S Medical Dictionary defines focal infection as "an infection confined ordinarily to a distinct location, such as the tonsils, or tooth sockets, from which at times micro-organisms or their toxins escape to infect other regions of the general system," and the medical definition of the word "focus" is given by the same authority as "the center or starting point of a disease process."

From the reading of the definition of focal infection, one infers, and correctly so, that disease conditions in and around the teeth constitute some of the most important and most frequent, if not *the* most important and most frequent, foci of infection found in the body. In this paper, therefore, I shall confine my remarks principally to those foci found in or around the teeth, or in tissues having a close relationship to the oral cavity, although I shall deal briefly with nearly all kinds of focal infections. Incidentally, I am better prepared to discuss foci of dental origin, as I am a dentist, and not a physician. No doubt, you have on your program today a physician who will discuss in more detail those foci of infection coming under his jurisdiction, which cause secondary disturbances in the eye or eyes.

Although at the present time the subject of focal infections is one of the most important and most widely recognized phases of medicine and dentistry, our knowledge of focal infections is a comparatively recent acquisition. It is true that the theory of focal infection has been recognized for nearly 100 years, but only in recent years has scientific investigation and experimentation established the theory as a fact.

It has now been proved that these infections may occur almost anywhere in the body. Billings gives us a list of diseases due to focal infection of some sort. With some condensation, it is as follows:

1. Different forms of rheumatism, rheumatic fever (with various types of heart involvement) and rheumatism of the joints, muscles, and other tissues.
2. Acute chorea, commonly called "St. Vitus' Dance," characterized by abnormal muscular movements, chiefly twitching, as well as nervous and mental disturbances.
3. Gonococcaemia, acute spreading gonococcus infection, and joint or muscular disease, like rheumatism, caused by the microbe of gonorrhea.
4. Malignant or ulcerative endocarditis—a disease of the lining of the heart, having a high mortality.
5. Nephritis, an acute or chronic kidney infection, with abnormal urine.
6. Acute appendicitis.
7. Cholecystitis, acute or chronic infection of the gall bladder.
8. Gastric and duodenal ulcer; acute or chronic stomach sores.
9. Acute, chronic pancreatitis, an infection of the pancreatic gland.
10. Erythema nodosum, a skin disturbance frequently associated with rheumatism.
11. Herpes (shingles), or skin eruptions due to nerve involvement.

*Read before the Georgia State Association of Optometrists, Atlanta, Ga., April 29, 1929.

12. Spinal myelitis, an affection of the spinal cord influencing gait and causing dizziness, or unconsciousness.

13. Acute osteomyelitis, an affection of the bone marrow usually occurring in the extremities.

14. Thyroiditis, swelling and inflammation of the thyroid gland.

15. Iridocyclitis, an affection of the iris of the eye. This has been further amplified by other authors, who now recognize that not only iritis, but inflammation of any part of the eye may be caused by foci of infection in the various parts of the body.

I should like to add that even mental diseases are now asserted to be the result of focal infection in numerous instances. Particularly is this claimed for such mental diseases as dementia praecox and manic-depressive insanity. Much of the speculation regarding the sources of mental diseases remains in the realm of theory. However, it has been proved by actual case records that at least some classes of mental disturbances may be traced directly to focal infection, particularly focal infection involving the teeth.

To give you an idea as to how frequently the tissues of the oral cavity, and especially those of the teeth, become the seat of focal infections, permit me to quote a paragraph from "Dental Findings in Ocular Lesions," by Cruttenden[1]:

Irons and Brown report detailed etiology of 200 cases of iritis. Infection in the teeth and tonsils was found in 42 per cent of the cases, tonsillar infection constituting 26 per cent, while dental infection was present in 16 per cent. Syphilis was a factor in 19 per cent, while 4 per cent of the patients had tuberculosis. Later, they reported a follow-up on fifty of these cases, covering from three to twelve years. Forty-three patients had no further trouble, seven had recurrences with unfavorable results; but of those patients showing favorable results, 37 per cent had their tonsils removed, and 30 per cent had their diseased teeth extracted. Thus, 67 per cent were benefited by elimination of infection from the throat and mouth. This careful study by Irons and Brown has been accepted by ophthalmologists as the strongest argument that mouth and throat infection constitutes the largest etiologic factor in diseases involving the uveal structures of the eye.

Tissues in the body which may harbor focal infections are too numerous to mention in this paper, and I shall attempt to name only a few of them. Aside from the oral tissues, the following are probably the most common seats of focal infection: tonsils, pharynx, lungs, liver and gallbladder (particularly the gallbladder), frontal sinuses, sphenoid sinus, ethmoid sinus, antrum of Highmore, middle ear, eustachian tube, kidneys and urinary tract, blood, when it harbors certain parasites such as the malarial parasite, spleen, pancreas, intestinal tract, particularly the duodenum, colon, rectum, lymph glands and prostate gland.

In fact, almost any tissue of the body may act as a seat of focal infection, or as a seat of secondary infection due to focal infection. Eye conditions, such as uveitis, retinitis and iritis, when the result of secondary infection from foci (and they usually are), are most commonly traced to such tissues or organs as the kidneys, the blood, the gallbladder, the intestinal tract, the throat, particularly the tonsils, and the accessory sinuses of the oral cavity. The latter are probably the most common nondental tissues acting as foci. The eye seems to be highly resistant to primary infection (excepting the common and not very serious disease conditions such as conjunctivitis and superficial inflammations of the external part of the eye), and nearly all cases of extensive eye trouble may be traced to a focus of infection, or a disease process in some other part of the body.

1. Cruttenden, L. M.: J. A. D. A., 15:246 (Dec.) 1928.

When treating serious diseases of the eye, the ophthalmologist should always make a thorough search for the focus of infection. It is almost impossible to arrest a disease condition in the eye, due to focal infection, until such focus is removed. It is evident, therefore, that there should be the closest professional cooperation between the ophthalmologist, the dentist and the general practitioner.

It may be well to give here a simple description of the anatomy of the eye, in order to refresh our knowledge on the subject.

The eye is enveloped by three coats or tunics, the outer fibrous tunic being composed of the "white" of the eye, or the opaque sclera, and a transparent portion called the cornea. In the second tunic are located the choroid, the ciliary processes and the iris, the latter tissue giving the color of the eye. The pupil is a circular disk piercing the iris. The delicate, translucent retina constitutes the innermost tunic. The optic nerve endings terminate in the retina. Three refracting mediums are found within these tunics: the aqueous, the crystalline lens and the vitreous.

You are all familiar with the trite comparison of the eye to a camera, which seems to be the general heritage of the laity. Unlike most common conceptions, this one is worth repeating, and we may say truthfully that the eye is analogous to a camera. The black choroid absorbs the superfluous light; the cornea and the refracting mediums focus the rays of light, and the retina reproduces the image on a sensitive plate. The eyelids may be compared to two movable curtains, or shutters, in front of the eye. The lining mucous membrane of these curtains is called the conjunctiva.

Now, any or all of the parts just enumerated may be involved in a pathologic process. As a rule, the more extensive the involvement, the greater the likelihood that the trouble is the result of a focus of infection somewhere in the body and more or less remote.

In his book, "Diseases of the Eye," DeSchweinitz says, in regard to the teeth as sources of primary infection:

> The teeth should always be examined and, if faulty, the patient turned over to a competent dentist. The frequent relation of carious teeth and pyorrhea alveolaris to corneal ulceration is well established, and the irritation of a new dentition in young children has been found to be the cause of abscesses or ulcer of the cornea. In brief, the entire cephalic mucous membrane should be explored, because in one or other of its component parts, it may be the seat of disease, which, even if it is not the cause of coexisting corneal ulceration, is more or less responsible for retardation of the healing process. Some corneal ulcers appear to have been caused by disease of the accessory sinuses, and by purulent retinitis, and if the tonsils are infected, they should be removed.

It has been my observation that bad teeth and bad tonsils go hand in hand, and are co-conspirators in establishing secondary infections in the body. When the tonsils are diseased, the teeth usually are, and vice versa.

DeSchweinitz also says that "tooth root abscesses may cause uveitis" and that "in general terms, the cause of uveitis may be septic or toxic." He says further:

> A certain number of cases depend on so-called constitutional diseases, or disorders of nutrition, for example: chronic rheumatism, gout, arthritis deformans, and diabetes; on disturbances of the internal secretions, such as the condition of hyperthyroidism; on specific infectious diseases such as influenza, syphilis, gonorrhea, tuberculosis, and specific fevers; on diseases of the blood, such as anemia; on auto-intoxication; on areas of sepsis (focal infections); on the pyloric region; urethra, bladder; appendix; the middle ear, the rhinopharynx, and accessory sinuses; on infections of the gums, such as pyorrhea alveolaris; on tooth root abscesses; on infections in the tonsils, the pharyngeal ring,

and the skin. Iritis and uveitis have developed after anti-typhoid vaccination.

Of course, the presence of focal infection or of secondary infection implies the presence of bacteria, as there can be no infection without bacteria or animal parasites. Of these two organisms, bacteria cause by far the greater number of infections. It would be well, therefore, to give some time to an explanation of the metastasis or spreading of the bacteria from a focus of infection to a secondarily infected tissue or organ.

Nonsuppurative conditions of the uveal tract are due to pyogenic organisms of diminished virulence, such as staphylococci (which are usually present in the various foci of infections that we have enumerated); streptococci and pneumococci. In dental infections, staphylococci and *Streptococcus viridans* are usually found, the latter being one of the chief factors in dental caries, or tooth decay.

The bacteria involved in focal infections find their way into the lymph circulation of the body, for, as you know, nearly all the organs and tissues of the body are furnished with a lymph supply as well as a blood supply. By ulceration and by proliferation, these organisms get into the lymph circulation in large numbers, and are transported throughout the body. From the lymph stream, they gain access to the blood stream, as there is a close relationship between the lymph and the blood vessel system. The terminal lymph capillaries and blood capillaries in most tissues are closely grouped in a dense network. The bacteria are able to resist the bactericidal action of the blood, by reason of the reduction of resistance in the blood, due to the primary infection. The bacteria then seek tissues for which they have a selective affinity, and if the resistance of such tissues is diminished by certain other conditions, such as malnutrition, the bacteria localize and start a secondary infection.

In secondary disturbances of the eyes from dental foci, reflex conditions in the eye may arise without the actual presence of the infectious organism in that organ, although the most common method involves the actual transportation of the bacteria to the tissues of the eye. For example, an infection at the root of a tooth may irritate the ends of the trigeminal and sympathetic nerves, and this irritation may cause a dilation of the blood vessels of the eye, thus giving rise to reflex disturbances. Disturbances so caused are usually transient, and disappear as soon as the infectious process in the tooth subsides. This accounts for some of the remarkable recoveries from eye conditions which take place after the extraction of teeth.

In secondary disturbances, not of the reflex type, the sinuses often play a part in the transmission of the infecting organisms, as they are in close anatomic relation to the upper teeth, especially the first, second and third molars. Indeed, the roots of certain of the upper teeth often penetrate the antrum.

In all cases of infection of the eyes resulting from dental foci, a thorough search for the causative organisms should be made in the blood, the periapical tissues and especially in the root canals of the teeth. The sinuses and tooth roots should also be examined, with the roentgen ray.

Permit me to quote a typical case of eye infection traceable to the teeth, as given by Harry A. Goldberg, chief of the Dental Department, Mount Sinai Hospital, New York City.[2] This is one

2. Goldberg, H. A.: Dental Infections; Systemic Manifestations and Bacteriologic Observations, J. A. M. A., 89:355 (July 30) 1927.

of thousands of cases that occur every day in medical and dental practice throughout the United States. It is by no means unusual, and I quote it as a typical case for which the teeth are specifically responsible.

Dr. Goldberg says:

Mrs. A. B., aged 23, with one child, an infant 4 months old, came to the eye clinic of the Mount Sinai Hospital, April 9, 1923. She had had pain and redness of the right eye for two days. Examination showed a marked ciliary infection, deposits on Descemet's membrane, a very deep anterior chamber, pupil dilated and irregular. The media was so hazy that the fundus was not visible. The deposits on Descemet's membrane were very large and numerous, and looked like mutton fat. Vision, right eye: movements of the hand; left eye: 20/50.

The diagnosis was not difficult. This was a typical case of uveitis. It is the etiology in such cases that usually is obscure. In this case, the Wassermann reaction was negative. A tuberculin test was also negative. Transillumination of the nasal sinuses was negative. The patient was referred to me for dental examination, and I reported as follows:

Oral examination showed bridgework on the upper and lower teeth. Roentgenographic examination showed many infected teeth underneath this bridgework. Advise the removal and culture of the infected teeth.

Local treatment, (atropine and hot compresses) was given for two days, without improvement. Salicylates in increasing doses during the next nine days produced slight improvement. The pain was relieved and the infection reduced, but the vision was still obscured by the haziness of the cornea and cloudiness of the aqueous and vitreous. Deposits on Descemet's membrane stood out as huge gray spots, covering nearly the whole area of the cornea.

Eleven days after treatment was begun, four teeth were extracted. Within seven hours there was a definite and decided improvement, noticeable to the patient herself. The vision suddenly cleared up. She could even read print, despite the fact that the eye was under the influence of atropine. April 25, five days later, the vision of the right eye was 20/70; there were still numerous deposits on Descemet's membrane, but the cornea between the spots was clear, and the fundus could easily be seen with the ophthalmoscope. . . .

From this time on improvement was steady and continuous. More teeth were extracted, until all infected foci were removed. The big, gray deposits were absorbed, and replaced by small, brown, pigmented spots, which, in turn gradually disappeared, and the patient was discharged, July 20, without active signs of eye disease. . . . There is no record of recurrence since then.

To a greater extent now than ever before it is apparent that the body is a complete organism with the functioning of each part dependent on that of another; that it is a vastly complex metabolic machine which functions properly only when all of its component machinery is synchronized into an effective unit. There is no particular part of the body which can be set aside exclusively for this or that man, whether it be the eyes, the ears, the teeth, the stomach or what not. Every health worker should know more than his particular field as defined by law. He is a poor dentist who has no practical working knowledge of the systemic relationship of oral health to body health, and he is a poor physician who does not regard tooth conditions as a frequent cause of secondary infection, and who does not apply such knowledge in his practice. By the same token, he is a poor optometrist who does not have at least a knowledge of the conditions causing the ocular disturbances which he is called on to assist in correcting. Some monarch once said, "The health of the people is the supreme law." The public is not interested in the vicissitudes of medical and dental practice. It *is* vitally interested in the preservation of its health. Such preservation of public health cannot be brought about

until there is intelligent and systematic cooperation between the various health workers.

The relationship of focal infections to diseases of the eye is but one phase of an all important health program. May I thank you for the opportunity of speaking to you upon it?

THE ECONOMICS OF RADIODONTIA AS RELATED TO EFFICIENT SERVICE*

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IN discussing the economic phase of radiodontia, this branch of practice must properly be considered as a professional service rather than merely the production of pictures. The roentgenograms are only records obtained during the examination, a means of determining conditions and the indications for treatment. Rational treatment is based on a correct diagnosis, and accurate diagnosis is promoted by a careful and competent examination. Therefore, the character of the examination determines the efficiency of treatment.

When a patient is accepted for examination or treatment, the practitioner assumes a legal obligation to render the service in a manner equal to the average standard of practice in the community. Since the average standard of practice in any community is wofully low, this leaves too much latitude to individual ambition and is not a sufficient obligation. Imagine the legal protection afforded by demanding the average standard of pulp canal operations or of shell crowns. It would be more of a penalty than a protection. The professional obligation assumed might better be described as employing the greatest knowledge and skill which the operator is capable of acquiring by diligent study and consistent endeavor for proficiency. A dentist with no more preparation than that required for a diploma and license who attempts to practice without intensive effort to improve his methods is not assuming his professional or his moral obligation. The laity cannot be expected to judge the technical qualifications of the practitioner or the efficiency of the service. Patients cannot protect themselves by judging the quality of professional service; the law affords inadequate protection; therefore, the professional ideals and personal honor of dentists offer the only protection in dental operations.

The purpose of a radiodontic examination is to reveal conditions in the teeth and supporting structures. The distinction between a radiodontic examination and merely "x-raying" the teeth is that a thorough radiodontic examination truly discloses everything possible within the limitations of the method, while teeth may be "x-rayed" so that the evidence is obscured or even misleading. The objective of a radiodontic examination is to reveal for diagnostic purposes the follow-

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ing structures: (1) an extensive periapical area, to observe structural changes and disclose foreign or anomalous bodies; (2) the roots of the teeth, with approximate accuracy; (3) the lamina dura entirely around the profile of the roots; (4) the crest of the alveolar process; (5) the pulp chambers and canals; (6) the approximal surfaces of the teeth. To attain this objective and verify the evidence, two or more views of each region are required. When anatomic or operative difficulties are encountered, the examination should be continued until every plan to obtain the information has been tried, or to the limit of safe exposure.

There is little prospect of securing the desired information unless a systematic technical procedure is followed. Without proof to the contrary, it might be thought that a fair proportion of excellent roentgenograms would be produced just by chance in radiodontic examinations. In applying this test to dental students who have been given lectures and demonstrations on systematic methods and to the majority of dentists who attempt to practice radiodontia without special training, it is evident that very seldom do they produce a satisfactory diagnostic roentgenogram. This statement suggests a description of the essential qualities in radiodontic negatives, which may be outlined as: (1) covering the field of examination to the greatest advantage; (2) showing no evidence of movement during exposure; (3) presenting a diagnostic view of the region with the minimum distortion of the image; (4) having a density suitable for the detail to be seen by the customary illumination; (5) registering the maximum contrast and definition consistent with penetration of the structures; (6) showing freedom from stains and abrasions; (7) presenting a symmetrical arrangement of the image on the film.

A standard of production would be of little value if it were unattainable, but, with suitable apparatus, any dentist worthy of the name could be taught to produce an excellent roentgenogram of a region in fifteen minutes. The technic for another region would have to be learned in the same manner, and if he did not assimilate or retain the instruction and grasp the principles, it would need to be relearned the next day. The reasons for the prevailing low standard of oral roentgenography are that it is technically difficult; most dentists have not had sufficient training in the technic, and there is not enough discrimination in the quality of roentgenograms.

To make any examination properly, the examiner should know what information is essential, the significance of unusual manifestations encountered, the means of obtaining the information and the limitations of the methods employed. In a radiodontic examination, the operator should know what information is essential to determine whether conditions are normal or abnormal, the significance of abnormal manifestations in diagnosis, the projection technic to obtain the most information and the limitations of roentgenography. These qualifications entail a thorough knowledge of the regional anatomy, an extensive experience in clinical dentistry and intensive training in radiodontia. It is unlikely that these qualifications would be possessed by any one who had not practiced dentistry and made a special study of roentgenography.

In a thorough radiodontic examination, the operator should obtain all the information possible in establishing a diagnosis and deciding the indication for treatment. To accomplish this, the operator must be a competent diagnostician

and familiar with methods and results of treatment. Although another practitioner may be responsible for the diagnosis and treatment, the radiodontist is responsible for the roentgenographic evidence obtained. The prevalent standard of radiodontic service does not supply the information obtainable, or that required for diagnostic purposes. A writer of a recently published article stated that radiography is merely an aid but was never intended to replace the special senses which the good Lord gave us for making a diagnosis. In reply, it can be said that the God-given faculties are dependable only after being trained for a purpose, and more training in radiography would make this diagnostician a greater credit to God. Knowing that the author of the statement depends on a girl assistant for his roentgenographic evidence, it is not strange that he trusts in God for diagnosis.

Radiodontia was established as a specialty about fifteen years ago and, like most dental specialties, has been developed without the general approval or support of the dental profession. The reluctance of the majority of dentists to refer patients to specialists has made it necessary for the dental specialties to be developed principally through the laity and the medical profession. This lamentable condition is best illustrated by the evolution of orthodontia. Before the growth of modern orthodontia, when dentists were consulted regarding malposed teeth, they removed the teeth and attempted some crude treatment or evaded the issue. After a few pioneers with a vision of rational treatment had demonstrated that malocclusion and facial deformity could be corrected, orthodontia was not assimilated by dentistry but became a distinct specialty. Now, with a brilliant record of service and progress, orthodontia remains generally unrecognized by dentists. Although some dentists fully cooperate with specialists for the welfare of patients, they are in the minority, and orthodontic practice is principally maintained through direct consultation by the laity. Not only do dentists fail to observe incipient dentofacial deformity and advise treatment, but it is also a common recital that when their attention is directed to it, they suggest waiting for the child to outgrow it. Exodontia has a more favorable position in dentistry, because of the exigencies of the practice. If the dentist cannot remove the tooth or is afraid to attempt it, he is relieved by referring the patient to an exodontist. This influence stimulated the development of exodontia and also exodontists, until it may soon be possible for each dentist to have his own private exodontist.

Radiodontia offered great assistance to dentists, but generally they ignored it except as the last resort. Not appreciating the advantages of performing operations by roentgenographic aid, dentists preferred not having roentgenographic inspection of the results. When the publicity given oral sepsis aroused physicians and the laity, dentists were compelled to participate or relinquish control of the investigation. The unprecedented demand for radiodontic examinations found only a few men who had foreseen the tendency and were specializing in radiodontia. Instead, commercial x-ray laboratories sprang up to capitalize the demand. Usually, the laboratories were operated by men who were not graduate dentists or qualified for the practice. Without a conception of the service indicated or an investment of time or money in professional education, the laboratory men established a low charge on a film

basis which, for the short time devoted to the alleged examination, was profitable to them. The abuse could not have existed without the tolerance and support of dentists and physicians who, unfortunately, did not have a higher conception of the requirements. With a low fee and a lack of discrimination in service, there has not been an economic incentive for capable men of high ideals to limit their practice to radiodontia. Conditions have been aggravated further by specialists in other branches attempting radiodontia as a side line and by dentists being induced to install roentgenographic equipment primarily for profit. A specialist is entirely justified in utilizing roentgenography in his field; but when he solicits independent radiodontic examinations, his motives and status as a specialist are questionable. From personal experience, radiodontia is a sufficiently extensive field to test one's ability without a division of interest and endeavors. Dentists whose location makes it inconvenient for them to refer patients for radiodontic examinations should have roentgenographic equipment and learn to use it, but it is not economically sound for twenty-five dentists in an office building to invest $25,000 in x-ray machines when one machine would serve the purpose.

Since the majority of dentists and physicians are satisfied with inferior radiodontic service for the sake of low fees, there is little immediate prospect for advancement of the specialty. The inability of patients to discriminate between "x-raying" the teeth and a thorough radiodontic examination, leaves the responsibility of the choice to the two professions. There was a time when ignorance regarding adequate radiodontic service was excusable, but the difference in standards has been amply demonstrated and emphasized for all, who so desire, to recognize. It is not surprising that the tendency in radiodontia is a compromise to the fee standard, instead of raising the service standard.

It is the privilege of professional men to have low fees or make no charge, but it is not permissible to neglect the service to reduce the fee. Neither is it professional to attempt to serve a larger number of patients than can be adequately served. Few men have a philanthropic motive in a low fee scale but are attempting to increase their income by a limited service to a larger number. Volume production is economic only to the extent that the quality of the product can be maintained, and beyond that it is exploitation. In professional service, the quality of which cannot be appraised by the patient, exploitation is dishonesty.

There was a time when dental fees were ridiculously low, and the service usually corresponded to the fee. Progressive influences have raised the standard of service, and the fee scale has proportionally advanced. Ten roentgenograms, usually of inferior quality, have been the standard in "x-raying" the teeth. With only a few minutes required for this deception, a few dollars was a profitable fee. When progressive influences establish a demand for radiodontic examinations which truly reveal conditions, a few dollars will not be a profitable fee.

The prescribed code of ethics forbids the advertising of a fixed fee for operations. Is it less ethical to have a fixed fee for operations when they vary in difficulty and time required? With a fixed fee, some patients are overcharged to compensate for those who are undercharged, without consideration of the comparative ability of the patients to pay the fee. The fixed fee custom in roentgenographing teeth not only detracts

from service standards but also is commercial in usually being on a film basis. A film basis for radiodontic fees is unprofessional because it places a financial restriction on the thoroughness of the examination.

The commercial tendencies in dentistry can be corrected by developing conscientious service as the primary factor, and having fees secondary but in proportion. Dental practice should be conducted efficiently and equitably, but business methods can easily be overdone. Preliminary discussion of procedure avoids misunderstandings, but pressure salesmanship and written contracts are foreign to professional relations.

THE MECHANICS OF ROOT-CANAL TREATMENT*

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SUCCESS in root-canal work, in a very great measure, is proportionate to the mechanical excellence of the operation measured in terms of surgical asepsis, the control of instrument trauma and chemical irritation to apical and periapical tissues and the complete obliteration of the pulp canal, both as to length and diameter to, but not beyond, the cementodentinal juncture.

There is no easy, gunshot, therapeutic method that conforms to biologic requirements.

ASEPSIS

Infection in and about the root ends of teeth must come from one of two sources, either by metastasis or by direct implantation in and through the root canal.

Since a study of thousands of roentgenograms of teeth reveals the fact that almost all of those infections are associated with teeth on which a root-canal operation has been performed or one in which caries has exposed, or nearly exposed, the pulp, it is logical to conclude that practically all periapical infections are the result of direct implantation in and through the root canals.

Therefore, one of the most important things in root-canal work is a thorough, yet practical aseptic technic. This means, first of all, that the operator should have within quick and easy reach an abundant supply of the many small instruments and materials that are to be used in the operation, all in an aseptic condition.

The variety and quantity of these instruments and materials call for special provision to take care of them properly. The pulp canal instrument case meets this requirement (Fig. 1). This case has a classified arrangement, with the idea of quick and easy access to the various instruments and materials required, all of which, when put in the case in a sterile or aseptic condition, are kept sterile by the use of formaldehyd, provision for which is made in the case.

HOW TO CARE FOR DRESSINGS

All dressings, such as points and bibulous paper pellets (Fig. 2) that are to be used in a root canal must be sterile. All of these dressings we dry bake in an

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ordinary hot air oven, controlled by a high temperature thermometer (Fig. 3). The dressings, in a covered container, should be placed in a cold oven and the temperature run up to 150 C. and held for thirty minutes, and then the oven should be allowed to cool gradually before opening. An ordinary laboratory Bunsen burner will supply abundant heat. These dressings are prepared in quantity in this manner and then transferred to the pulp-canal instrument case and kept under formaldehyd gas. All points and other dressings to be inserted in the pulp chamber or root canal should

Fig. 1.—Pulp canal instrument case.

be handled only with sterile pliers, never with the fingers.

Guttapercha points are sterilized in quantity by dropping them into tincture of iodin for five minutes, then into "sodiphene" five minutes to remove iodin stains and further sterilize them, and another five minutes in alcohol to remove the sodiphene. They are then dried on sterile gauze and stored in the pulp-canal instrument case under formaldehyd gas.

DANGER FROM IMPERFECT BROACHES

New broaches, particularly barbed broaches, are dangerous until tested by using. Quite often, a weak spot in a broach is not discovered until a part of it is left in a root canal. It is quite desirable to be able to use a good broach over and over again as long as it is effective. This has led to the development of the alcohol sterilizer (Fig. 4), which has three shallow wells for short or style B broaches, three deep wells for long or style D broaches, and a large central well for dipping mouth mirrors, rubber-dam clamps, etc., for alcohol flaming (Fig. 5). Scissors, pliers, pluggers, etc., can be immersed in the deep wells for sterilizing and flaming. After any instrument is flamed, it should again be dropped in the alcohol bath, to cool and be better sterilized.

Fig. 2.—Absorbent pellets.

When preparation is made for a root-canal operation, a series of three succeeding sizes of broaches are used, several of each size being placed in each succeeding well. These should always be removed from the pulp canal instrument case with sterile pliers. The handles of these broaches will stand in a semicircle about the circumference of the wells (Fig. 6).

It must not be conceived that the idea is simply to shake or dip broaches in alcohol for a second or two. The habit should be formed of taking the broach standing nearest (Fig. 6*1*)from a well and, after using, to clean mechanically and replace it at the farthest side of the

semicircle (Fig. 65), so that it will remain in the alcohol until we have used, in turn, each broach in front of it before we again use it, or a lapse of at least five or six minutes. The same routine applies to the use of short or style B instruments.

MECHANICAL CLEANING OF BROACHES

Special emphasis and attention must be given to the mechanical cleaning of broaches before they are replaced in the alcohol bath; first, because the instrument is of little or no value for further use unless it is cleaned, and, secondly,

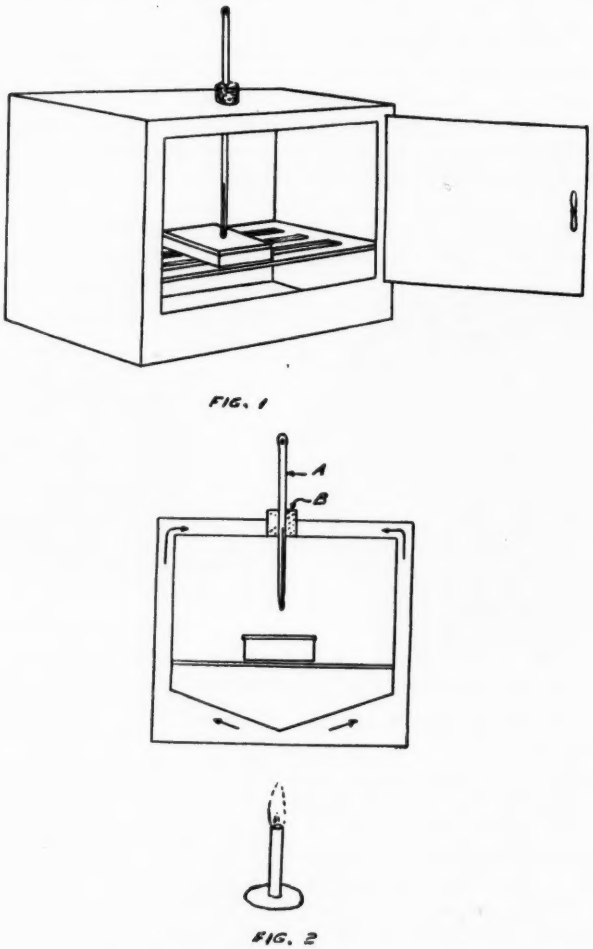

Fig. 3.—Hot air oven.

with a mass of bacteria left on a broach, the alcohol would coagulate the outer layer of protoplasmic cells, and thus protect for a longer time than five or six minutes those cells in the center of the coagulated mass. In this manner, five or six minutes in the alcohol would fail to sterilize the broach. A good sized mandrel-mounted tooth cleaning bristle brush (Fig. 7) is very effective for removing débris from a broach when used as a brush held with the fingers, care being taken not to use force enough to break or distort the broach. Double surety in sterilizing and cleaning broaches can be had by dipping them in phenol and brushing until clean, then rinsing in alcohol before putting them back in the alcohol well.

Fig. 4.—Alcohol sterilizer.

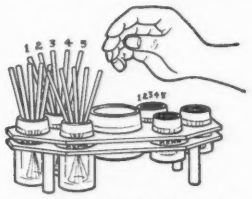

Fig. 6.—Sterilizing broaches.

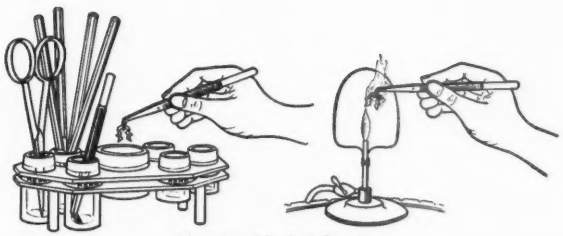

Fig. 5.—Alcohol flaming.

When you are through with an operation at a given sitting, all broaches should be up-ended in the alcohol wells, and by grasping the broaches between thumb and finger, the handles can be alcohol flamed and dropped back into the wells to cool and further sterilize them, then transferred to the root canal instrument case if good for further use.

SURGICAL CLEANLINESS OF OPERATIVE FIELD

All operative procedures should be based on a surgically clean rather than an antiseptic technic. It is good practice before starting a root-canal operation to give the entire mouth of the patient a thorough prophylactic treatment. Then the rubber-dam should be applied whenever possible and the field of operation painted with tincture of iodin and allowed to dry. The iodin stain can easily and quickly be removed, if desired, by applying sodiphene (50 per cent) and the field dried with alcohol.

The use of the rubber-dam in root-canal work is strongly advocated, and it should never be omitted except in those few unusual cases in which its application is distinctly contraindicated, and, in such cases, a root-canal operation should not be attempted unless the field can be

kept surgically clean by some other means.

Although from 65 to 70 per cent alcohol has greater germicidal efficiency, I recommend the use of 95 per cent grain alcohol in all wells to facilitate flaming and the use of alcohol in root canals. Only government tested 190 proof grain alcohol should be used.

When débris gathers in the bottom of any well, the alcohol can easily be drawn off with an all-glass syringe, the well wiped clean with cotton and the alcohol put back. A large sized all-glass syringe should be kept for this purpose.

Fig. 7.—Mandrel-mounted tooth-cleaning bristle brush.

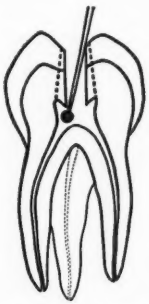

Fig. 8.—Opening pulp chamber with round burs.

For the benefit of those who can think of asepsis only in terms of the autoclave or steam sterilizer, I would remind you that the condition of an instrument or dressing at the *beginning* of an operation is indeed important, but is only part of asepsis as applied to an operation on living tissues. An autoclaved broach becomes septic the instant it enters an infected root canal, and if used too long or carelessly, becomes an instrument of vaccination, or of inoculation, if forced through the root end into periapical tissue, thus planting septic organisms. The more often an instrument is exchanged for one that is sterile, the better is our aseptic control. Asepsis must be applied to technic, or the manner of using instruments and dressings, as well as to their degree of sterility at the beginning of an operation.

There are always weak links in any chain of aseptic technic when it has to do with an operation on diseased living tissues. But, of course, we know that general surgeons do not abandon aseptic surgery altogether just because there are weak links in their chain of technic. They practice the best asepsis possible,

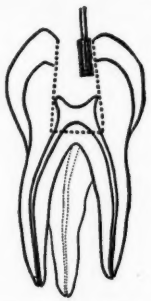

Fig. 9.—Opening pulp chamber with square end burs.

always striving to strengthen the weak spots. So must we, as dentists, study carefully our problems and try to *strengthen the weak spots* in our technic. Practically all surgical asepsis is relative, not absolute. Let us analyze our problems and be careful that our deductions are as nearly correct as possible.

In our root-canal technic, the least possible curetting or instrumentation is done in an infected tooth until after the canals have been evacuated and washed (surgically drained) over and over again, using points and a diluted surgical solution of chlorinated soda. The mass of

infective matter will be greatly lessened, to say the least, by this process, so that when the broaches are used, they will not be so heavily loaded with septic débris and their mechanical cleaning and alcohol sterilization will be more effective.

The lessening of sepsis in a tooth is by a constantly increasing ratio with each succeeding treatment until, at the proper time for root filling, we have removed most if not all septic matter and the alcohol sterilizer properly used is not given anything which it cannot do.

INSTRUMENTS AND EQUIPMENT

Too many operators try to do root canal work without proper or adequate equipment. The lack of proper instruments and the effort to do the work with only a few imperfect ones only increases the difficulty and is largely the cause of failure to accomplish desired results.

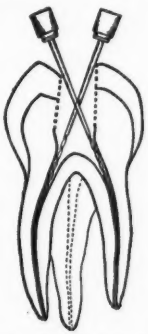

Fig. 10.—Occlusal openings.

After the rubber-dam is applied and the field sterilized, as previously described, all fillings and carious matter should be very carefully and thoroughly removed with burs and excavators in such a manner as not to carry débris into the pulp chamber and canals.

Only round or oval burs should be used when opening the pulp chamber (Fig. 8) and care taken never to destroy the natural curves and contour, which are a valuable guide to the opening into each root canal.

If fissure burs or other square-end burs are used (Fig. 9), all natural lines in a pulp chamber are destroyed and the work of finding the canals is made more difficult.

The amount of tooth structure to be cut away should ordinarily be only such as will give a direct line of entrance into the several canals. Occusal openings are shown in Figure 10. For proximal cavities, the opening should be carried back over the occusal surface far enough to give direct line of access, as indicated in Figure 11.

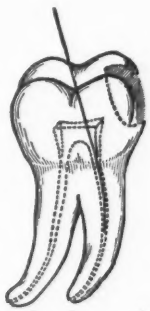

Fig. 11.—Opening for proximal cavities.

After a sufficient opening has been made with burs, as indicated above, pulp chamber excavators (Fig. 12) are used to clean out all detritis or débris from the pulp chamber. These instruments are long, sharp, hawk-bill excavators made in a right and left and a push and pull, designed in such manner that débris can be retracted and removed rapidly and efficiently without destroying the pulp-chamber contour or producing pressure that will force some of the root canal contents into the periapical region.

If a pulp is to be extirpated, a barbed broach is the best instrument with which

to entangle and remove it. This broach should have all the toughness and flexibility possible without any of the dangerous, brittle properties of a hard or spring tempered broach.

These properties, with a wide gradation of sizes, in order that one can be chosen that will go well up into a given canal without binding, are to be found in the soft tempered barbed broach (Fig. 13).

These broaches are mounted in long and short handles and range in sizes from 1 to 6. They are also very effective for removing shavings and débris from canals during the process of scraping and enlarging with files, reamers and hard tempered barbed broaches.

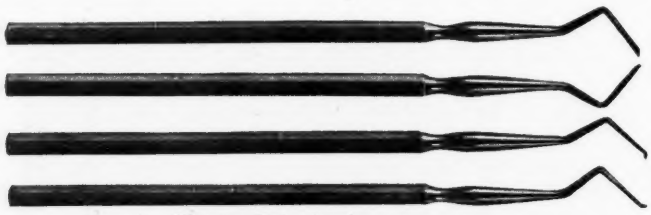

Fig. 12.—Pulp chamber excavators.

Pulp canal files (Fig. 14), pulp canal reamers (Fig. 15) and hard tempered barbed broaches (Fig. 13), like the soft tempered barbed broach, are mounted in long and short handles and run in sizes from 1 to 6. An important factor in these instruments is that they are all mounted to the same standard lengths, which approximate the average length of a tooth. This aids greatly in the measurement control of operative work (Fig. 16)—the handle coming close enough to some landmark on the tooth to serve as a measurement guide.

I believe that the measurement control of all instrumentation in a root canal is one of the most important factors in securing successful results. By measurement control, I mean that, as soon as possible after extirpating a pulp or otherwise entering a root canal, the operator should establish by measurement wire and roentgen ray the exact point in a tooth to which he wishes to go with his root filling, and all broaching or other instrumentation must be governed by that measurement.

In selecting the kind of instrument to use in the first efforts to open and enlarge the finer root canals, careful study of Figure 17 will easily demonstrate that the twisted type, such as a Kerr pulp canal file, will have much more metal to the given diameter of a canal than a barbed broach can have, with the added advantage of having no weak spots, such as the cuts made in turning out a barb.

Considering all of these factors, it is easy to see that files and reamers have a much greater margin of safety when working in fine canals, while barbed broaches have greater space around and between barbs in which to pick up and remove loose débris after the canal is enlarged sufficiently for them to pass in *without binding.*

The smooth or so-called pathfinder broach has no place in our technic, because if we succeed in passing a smooth broach to the end of a root canal, it can serve no purpose in cleaning or enlarging the canal, unless we use it as a stirring rod to carry sulphuric acid into the canal to open chemically and enlarge it, and

this we believe is not a safe thing to do since the vitality and health of apical and periapical tissues are so essential.

Figure 18 is intended to show what we consider wrong technic in working in posterior teeth. Never bend long mounted broaches at right angles and thus try to work into root canals, or the bending and distortion which occurs when pressure is applied will carry the point of the broach out of the axial line of the canal (Fig. 19). We think the short handled or style B broaches (Fig. 20) held between thumb and finger are much more effective. A rather sharp bend in the tip of a broach (Fig. 21) will often help us in following curved roots or getting by shoulders or projections.

In our work of opening and enlarging root canals (Fig. 22), we divide the root canal into three almost equal parts, a coronal third, a middle third and an apical third.

If the canal is fine, our first instrument is a No. 1 Kerr pulp canal file. This is bent to match the curvature of the root and, by a rotary oscillating, back and forth, slightly twisting movement, passed up into the canal to the total depth established by measurement wire as the limit of our operative effort. Then, by a retracting and slightly rotary movement, exerting pressure sidewise in all directions, the canal is filed and enlarged until the instrument works free and easy, all the time being kept well up to full depth

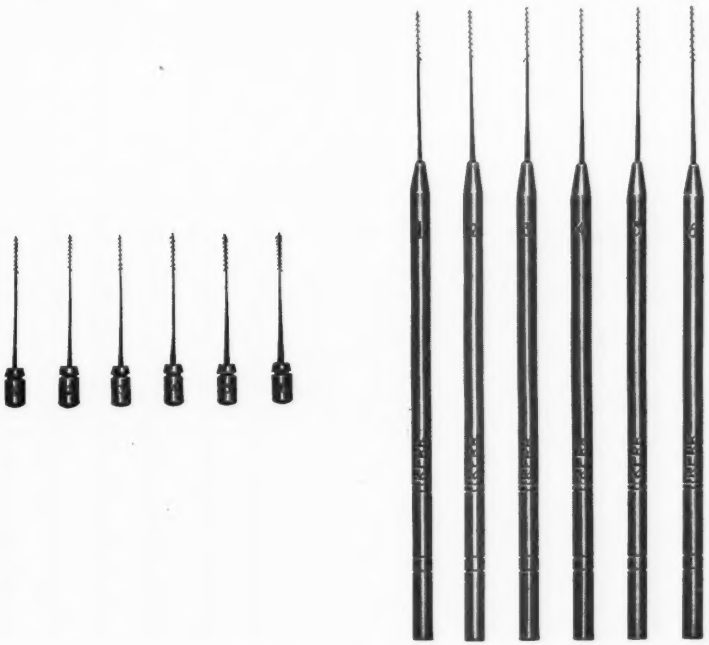

Fig. 13.—Barbed broaches.

in the canal. This is followed with a second and a third No. 1 file, each one aiding in enlarging and cleaning the canal. Do not be in too great a hurry to use larger sized instruments. The next instrument to use is a No. 1 pulp canal reamer. We use three of them, one after the other, in the same manner as the No. 1 files. We follow the No. 1 reamers with No. 2 files, No. 2 reamers, No. 3 files and No. 3 reamers. This, which tempered barbed broaches for scraping or curetting this part of the canal. Care must be taken not to work too long at a time with these hard broaches or the canal will be blocked with shavings. At frequent intervals, the débris should be picked out with smaller sized soft tempered barbed broaches, files or reamers; the operator being sure to keep the canal open and free of obstruction to the measurement control depth. Each succeeding

Fig. 14.—Pulp canal files.

completes what we call the first stage of our work, will result in a very considerable enlargement of the coronal third of the canal (Fig. 23) and, at the same time, succeed in keeping open and slightly enlarging the rest of the canal.

The second stage or middle third of the canal can now be quite rapidly enlarged by using No. A or fine hard-size of hard barbed broaches are used, followed by soft barbed broaches to remove débris from canal, until what is illustrated in Figure 24 has been accomplished.

Too many operators are willing to insert a filling at this stage, but five or ten minutes' use of pulp canal reamers in succeeding sizes from No. 3 on up to No.

4, No. 5 or even No. 6 will give us a canal large enough in this apical third (Fig. 25) to enable us to place a good sized guttapercha cone by measurement to the desired point in the root canal (Fig. 26).

After completing the preparation of a root canal and before inserting the root filling, it is very desirable to place what we call a test cone in the tooth as described above, and take a roentgenogram (Fig. 27) to see whether it goes to the desired point in the canal.

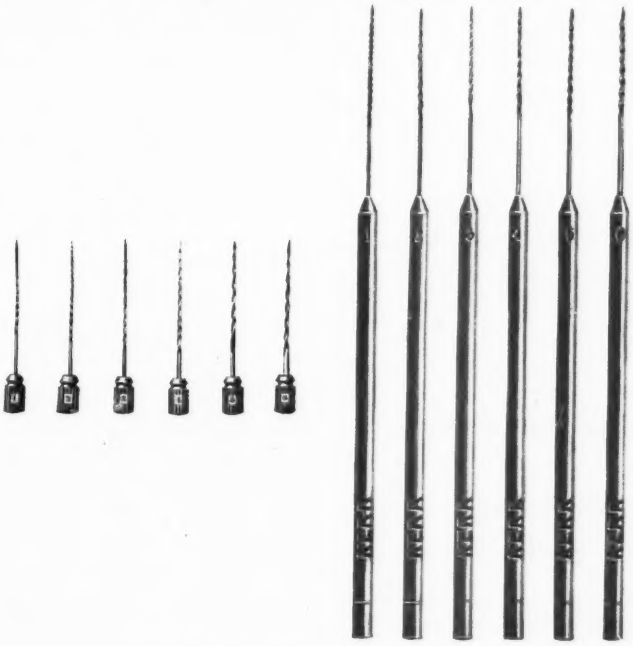

Fig. 15.—Pulp canal reamers.

HOW THE TEST CONE IS OBTAINED

The test cone is secured in the following manner: Select a good sized guttapercha cone of greater length than the tooth as established by measurement wire and having a good uniform taper (slightly less than the taper of the canal) of such dimensions as to allow the cone to pass easily to the full depth of the canal preparation. Now begin cutting the small or fine end of the cone off a little at a time, using sterile scissors out of the alcohol bath, until the cone is large enough to fit tight in the apical third of the canal and yet go the entire depth by measurement. Now cut off as much of the large end of the cone as protrudes beyond the landmark on the crown selected for measurement control.

If the test cone roentgenogram shows that the canal preparation is satisfactory and the cone goes to the desired place and fills the entire diameter of the canal in the apical third, this test cone is removed and kept for future reference and comparison as explained below. It now is

our best measurement guide both for length and diameter.

HOW TO FILL ROOT CANALS

The complete obliteration of a root canal (Fig. 28) is accomplished in the following manner. Several guttapercha cones are prepared in exactly the same manner as the test cone was made (by fitting cones in the canal as described above) but cutting them 1 mm. longer at the large or crown end so that these cones will be 1 mm. longer than the measurement control length. These are given a final alcohol bath and laid out to dry upon a sterile bracket or glass slab where they can be quickly picked up when wanted.

Fig. 16.—Measurement wire.

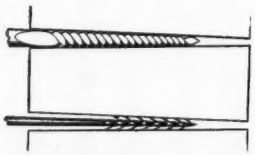

Fig. 17.—Comparison of twisted type file and barbed broach, showing that the former is better for opening and enlarging finer root canals because it affords more metal to the given diameter of a canal and in addition has no weak spots.

Now select the one cone from those prepared that you feel is the best and most nearly perfect and cut off about 1 mm. at the small end. This brings this cone to measurement control length, but if you have followed directions, this dry cone will lack 1 mm. of going to the full depth in the canal (being too large to do so) and will project 1 mm. beyond the landmark on the crown selected for measurement control guidance. Place the patient's head in such position that two or three drops of rosin-chloroform solution carried by pliers will stand over the entrance to the root canal. If there is more than one canal, pack all but the one being filled with paper points to keep the rosin-chloroform solution out until you are ready to fill each in turn.

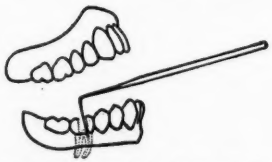

Fig. 18.—Wrong technic in posterior teeth.

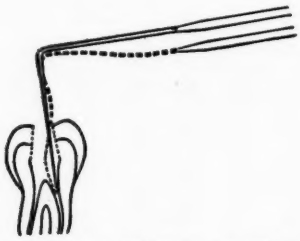

Fig. 19.—Wrong technic in posterior teeth.

Quickly but firmly pick up the selected guttapercha cone, and promptly, without plunging, pass it up into the canal along one side wall until you are almost to full depth. At this point, the cone should fit the canal closely enough to induce capillary attraction and, by a few very slight or short pumping movements, the rosin-chloroform solution will be drawn into the full depth of the canal (of which fact the patient should be instructed, to give a signal at the slightest pain from chloroform) and by lubricating and slightly

dissolving the surface of the guttapercha cone, you will accomplish two things at the same time: first, the sealing of the dentinal tubules with rosin-chloroform-guttapercha varnish, and, second, just enough reduction in the guttapercha cone that it may be forced on down to the full length of the preparation in the canal. This is accomplished by carrying the guttapercha cone into the canal until the large end of the cone comes even with the landmark selected in the crown of the tooth for measurement control.

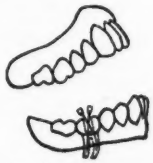

Fig. 20.—Right technic in posterior teeth.

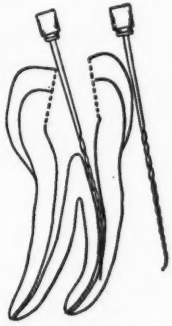

Fig. 21.—Sharp bend in tip of broach.

This must all be done as expeditiously as possible and in a manner to use only the minimum amount of rosin-chloroform so that none will be carried beyond the end of the guttapercha cone into apical or periapical tissues.

The purpose in view is to get as nearly a solid guttapercha cone as possible in the apical third of the canal. With a sharp hot instrument, quickly cut off the guttapercha cone even with the floor of the pulp chamber. With one of the guttapercha spreaders (Fig. 29), taken from the alcohol bath so that the alcohol will keep the rosin-chloroform from adhering to it, push up into the canal along the side of the guttapercha cone and firmly press it against the side walls of the canal, then force in another guttapercha cone, cut it off with the hot instrument and plug and condense the guttapercha with pulp canal pluggers (Fig. 30). If the canal is elliptical in the coronal and middle thirds, it may be necessary to force in more than one cone as described above to completely fill it. Care should also be taken to select a cone of a size that it will go the full depth penetrated by the guttapercha spreader, careful notice of which should be taken.

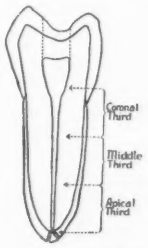

Fig. 22.—Root canal divided into thirds.

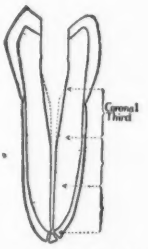

Fig. 23.—Coronal third.

The above described method of filling root canals has the following advantages: If the canal is properly prepared, that is,

scraped and curetted so as to remove all pulp tissue and thereby be made large enough in the apical region to have a definite choked or constricted ending at the cementodentinal juncture, a good sized guttapercha cone can be tightly seated in the apical third against the choked or constricted shoulder near the end of the root without excess filling going beyond the root end. This accomplished, the long tapering guttapercha spreaders can be forced in along the side of the cone and the maximum pressure be obtained to force the guttapercha against the walls of the canal with the least possible apical pressure that would tend to force filling material through the root end.

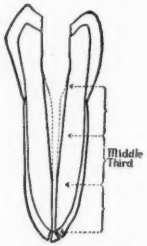

Fig. 24.—Middle third.

OTHER METHODS OF FILLING ROOT CANALS

The sectional method of filling a root canal has the advantages of a rigid steel plugger to help force a tighter fitting section of guttapercha into the apical third than by the above described method, but the disadvantage of creating too much apical pressure when succeeding sections of guttapercha are condensed one against the other, with the likelihood of displacing and forcing the apical section beyond the root end.

The technic of using a semiliquid or paste root canal filler presents what seems to me great difficulty in controlling the filling material so that we know it is going just to the desired point and no farther.

After carefully studying the various methods mentioned above for the obliteration of a root canal, we wish to present a technic that makes use of what we believe to be the best mechanical features of all three methods.

The opening and enlarging of the canal is as described above. Secure the test cone in the same manner as previously described. Prepare the several additional cones in the same manner as the test cone.

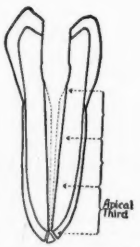

Fig. 25.—Apical third.

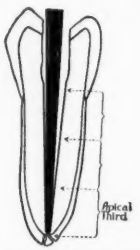

Fig. 26.—Guttapercha cone in canal.

Instead of bending a plugger to mark approximately (not exactly) how far it will go up into the canal, we select a contra-angle measurement control plugger of the size to go to the desired point in the canal where we wish to place the first section (apical section) of guttapercha cone. On this plugger is placed a threaded sleeve nut that may be adjusted up or down to a definite landmark on

the tooth (Fig. 31). Select as above described the best cone from those you have prepared, always preserving the test cone for measurement control and comparison, and cut off 1 mm. (more or less according to the amount of taper in the canal preparation) from the small end exactly as described above, and then cut the first or apical section of guttapercha from this shortened cone of the correct length so that, when fastened to the plugger point, it will measure test cone length to the sleeve nut (Fig. 32).

These pluggers have several different length sleeve nuts to meet requirements for all lengths of root canals from cut-off teeth to long cuspids.

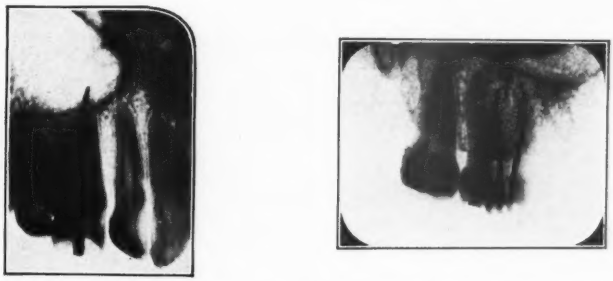

Fig. 27.—Left: Test cone in cuspid. Right: Test cones in molar.

The measurement control plugger with cone section attached is placed on the bracket ready for use. Rosin-chloroform is carried to the mouth of the canal and one of the prepared guttapercha cones, to match the test cone, is passed up into the canal as previously described and, by a very slight pumping movement, the walls of the canal are lubricated and coated exactly as before with rosin-chloroform varnish, the operator being sure to carry none through the foramen.

After freely coating the walls of the canal in this manner, remove the guttapercha cone and quickly pick up an absorbent point, previously cut to match the test cone, moisten it in chloroform and pass it into the canal to absorb the excess chlororosinpercha solution that may be present. Then, as quickly as possible, pick up the plugger with the cone section attached and press it home into the apical portion of the canal up to the sleeve-nut-landmark control. Give the plugger a right and left twist to detach it from the cone and take a roentgenogram at once to see if the section goes to the desired point. If it is short, you can adjust the sleeve nut on the plugger, which will enable you to force the section of guttapercha on up to the exact point by measurement control.

To prevent pressure likely to displace this apical segment of guttapercha, a root canal sealer is worked into the rest of the canal, being followed with a guttapercha cone of sufficient size to crowd the paste against the walls of the canal without creating enough apical pressure to disturb or move the section of cone in the root end.

There is more than one way to fill a root canal. We have called your attention to the main factors of several methods, all of which have for their aim the complete hermetical sealing of a root canal from the cementodentinal juncture to the floor of the pulp chamber.

The rosin-chloroform solution enters and occludes the tubules and, when properly manipulated, as above described, in conjunction with tight fitting guttapercha cones, it effectually seals the root end against osmosis and diffusion.

As in inlay casting or any other technic having variable methods and materials, so it is in root canal technic: the operator should decide on a definite method which, in his hands, will give the highest degree of success; then, by persistent work and effort, he should overcome deficiencies until he masters a procedure which he knows and can prove fulfils the requirements as outlined in this brief paper.

We suggest that every operator who desires to improve his root canal technic begin by selecting single-rooted extracted teeth and mount them in a small block of modeling compound, then carry through the technic exactly as described in this paper until rewarded by a definite understanding of each step in the procedure as outlined. He should then apply this experience to only single rooted teeth in the mouths of patients until he is master of it, before trying to treat difficult multirooted posterior teeth.

In cases of young people with single rooted anterior teeth needing root canal work because of fractures or other injuries from accidents or even caries, it will often happen that the root canals are already larger than any instrument yet described (Fig. 33).

Fig. 28.—Left: Final filling in cuspid. Right: Final filling in molar.

I well know that I have not stated in detail just how to overcome every difficulty that will arise in cases of obstruction of canals from pulp stones and other calcific degeneration, also mutilation of canals from previous defective operations, etc.

To do so would require hundreds of pages of doubtful descriptions, and I believe that all such difficult and doubtful cases could well be eliminated if the practitioner would master a technic for handling the more hopeful cases and thus stop making these difficult and hopeless conditions.

For these cases, the operator should keep a set of pulp canal reamers size 7 to 12 (Fig. 34).

I prepare special guttapercha cones rolled to meet the requirements of these unusually large canals.

This paper has been written primarily as a guide in root canal technic. Therefore, it necessarily justifies the retention of certain pulpless teeth for selected groups of individuals where correct operative results can be obtained.

I wish strongly to restate my belief that infected pulpless teeth are a grave menace to the health of their host; so much so, that I am convinced that pulpless teeth presenting with a history of disease and roentgenographic evidence of destruction of periapical tissues should be extracted in the majority of cases, and discriminating judgment must be used in the selection of cases to be treated.

The following quotation from an editorial in the February, 1928, issue of *Dental Cosmos* seems to me to be well stated.

This much we are sure of and have proved beyond question: that the uninfected pulp of a tooth may be removed and replaced with a filling material, with absolute assurance that no untoward results will follow; that many infected teeth may be so treated with safety; that the operative procedures which lead to this happy result are relentlessly exacting; that intelligent diagnostic and prognostic ability must be exercised; that the vital resistance of the individual is a most important diagnostic factor; and, lastly, that discriminating judgment must be used in the selection of cases to be treated.

Again we quote[1]:

Probably the most depressing feature of the studies reported by these histologists is the high percentage of poorly treated and filled root canals in the teeth they have examined. Of course, it is hard to get people to part with teeth that have been successfully treated, so that undoubtedly the teeth examined by the histologist are not a fair representative section of conditions as they exist. The conditions are probably better than are shown by these statistics. In spite of this supposition, it is very clear that three types of incomplete treatment are common, namely:

First, the canals are very superficially cleansed and much of the pulp tissue is not removed. It is probably true that all the pulp tissue cannot be removed until the shape, course and diameter of the canals are modified by filing and curetment. Yet the efforts of the operators to remove the pulps, as observed in treated teeth, are frequently pitifully inadequate.

Second, the filling is not brought close to the apex. In other words, the canal is incompletely filled longitudinally. While this type of incomplete treatment may and should be criticized, yet in some instances it certainly is not as serious a matter as discrepancies in the first or last form of inadequate treatment, and furthermore, mistakes of this kind are easiest seen in the x-ray film. It is wise to believe that failure to bring the filling reasonably close to the apex does handicap a favorable outcome, because all of the statistics prove that restorations are more common about well-filled teeth, as determined by the x-ray.

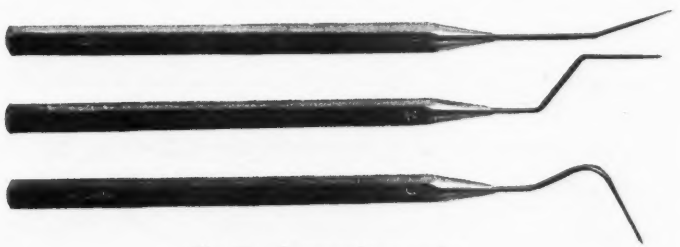

Fig. 29.—Guttapercha spreaders.

The third type of failure should be considered most serious of all; that is, when the diameter of the filling material is considerably less than the diameter of the pulp canal. It allows circulatory elements to pass between the filling and the wall of the canal by capillary attraction and diffusion and also permits the passage of bacteria and toxins from one part of the tooth to another. This cannot be recognized in the x-ray film and it is the most

1. Hatton, E. H.: Dent. Cosmos, 70:251 (March) 1928.

common of the three failures made by dentists in the treatment and filling of canals. A great deal has been said about the shrinkage of guttapercha, and it might be concluded, if nothing more were said, that all of these discrepancies were the result of the shrinkage of the guttapercha. It is, however, the opinion of these histologists that it is not the shrinkage of the guttapercha that produces the results they have described, but the way in which it is put in. All of them describe numerous results in which the full diameter of the canal is occupied by a guttapercha filling. On the other hand, they show many more with one or more tiny guttapercha cones projecting into large root canals two or three times greater than the diameter of the cone or cones.

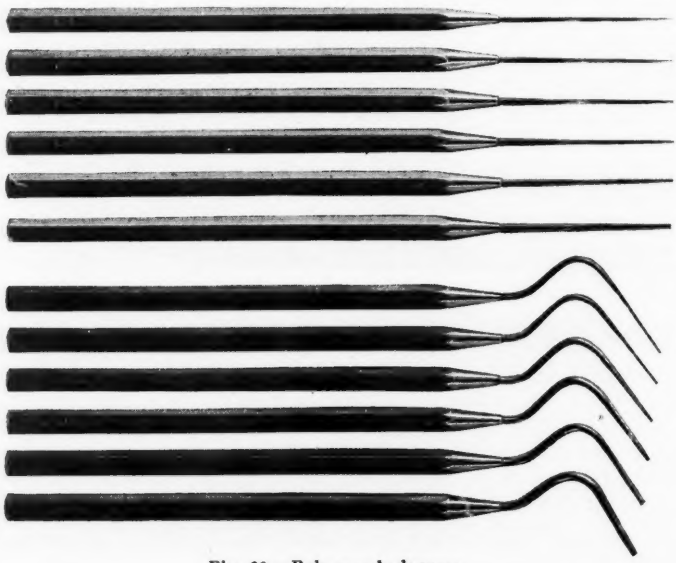

Fig. 30.—Pulp canal pluggers.

The foregoing quotation from Dr. Hatton is to me a classic picture of the failures in root canal work as practiced by altogether too many dentists, and naively implies, first, that complete removal of the pulp can be accomplished only by very considerable "filing or curetment"; secondly, the filling should be carried close to the apex, and, thirdly, most serious of all is the failure to fill the full diameter of the canal. Thus, he does not "relieve us" of the necessity for mechanically cleaning and enlarging a root canal and completely filling it as to both length and diameter.

We believe that every practicing dentist should restrict his root canal work to single rooted, easily accessible teeth with vital pulps, or without periapical involvement, until he is sure that he has mastered surgical procedure and mechanical skill sufficient to obtain operative results which fulfill the requirements as stated or described in this paper.

The time and effort required to do a correct root canal operation puts it forever out of the class of a "$5.00 filling with root canal thrown in." If the

economic problem arises, and the patient "can't afford" to have a root canal filling well done, surely it is more honorable to extract the tooth than to perform a defective operation with the danger of subsequent infection.

SUMMARY

1. Most important is a complete and correct diagnosis of each individual case. Dental diagnosis thus assumes a necessary and important place in our new responsibility as a branch of the healing art. Mouth examination and charting with proper use and interpretation of correctly made roentgenograms along with electric pulp testing, transillumination and all other aids in determining the health or disease of the teeth and their supporting tissues must be recognized as fundamental in all efforts to locate and eliminate oral foci of infection.

2. The primary issue or major problem is not the determination of methods of treating infected root ends, but the development of a technic for the removal of vital pulps in such a manner that a healthy root end will be maintained in a satisfactory percentage of cases.

3. As infection is undoubtedly the greatest factor in failures in root canal work, surgical asepsis is of prime importance, and the root canal filling must seal the canal as to both length and diameter, thus obliterating completely the spaces in which fluids may collect and there serve as culture mediums.

4. Second only to asepsis is the measurement control of instrument trauma and therapeutic injury to the apical and periapical tissues. The importance and value of maintaining the vitality and health of the apical and periapical tissues cannot be too strongly emphasized.

5. No tissue destroying drugs are safe in root canal work, and pulp extirpation should be done surgically under general anesthesia, nerve block, infiltration or pressure anesthesia.

6. Sensation alone or response from the patient are not sufficient and safe guidance in root canal work; but both of these in conjunction with roentgen-ray and measurement control are a very valuable aid in operative work.

7. Root canal work should not be attempted without the aid of the roentgen

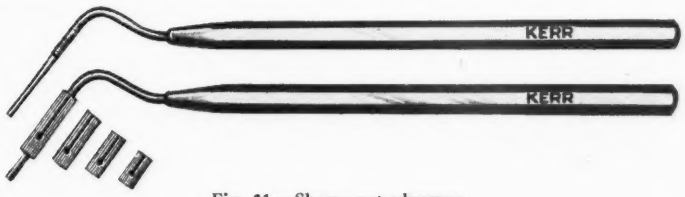

Fig. 31.—Sleeve nut pluggers.

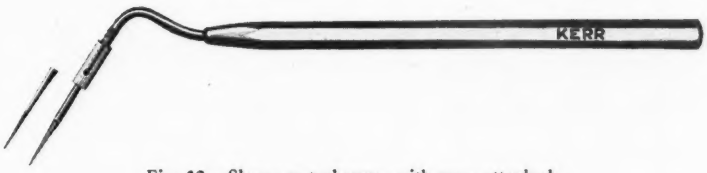

Fig. 32.—Sleeve nut plugger with cone attached.

ray, or without a proper and adequate supply of instruments and equipment.

8. A vital pulp should never be destroyed or removed except for cause, and that cause is disease or a condition almost certain to result in death of the pulp.

9. Diseased teeth should not be treated for sick people.

10. One tooth should not be treated for a patient and other teeth which show evidence of infection be left untreated.

11. The operator should not enlarge the apical foramen or go beyond the cementodentinal junction with either instruments, dressings or root filling material.

12. A tooth should not be left unsealed. Saliva should never enter the canal after treatment is once started.

Fig. 33.—Large canal.

13. The operator should evacuate, retract or remove canal contents, not pump, push or expel septic matter through the root end.

14. Conclusions should not be drawn from results obtained in just a few special cases under observation for only a short time but must be made from tabulated records of many case histories running through a long period of time.

15. In root canal work, success in a great measure is proportionate to the mechanical excellence of the operation measured in terms of surgical asepsis, control of instrument trauma and chemical irritation and the complete obliteration of the pulp canal as to both length and diameter to, but not beyond, the cementodentinal junction. The apical third of a root canal is the most important part of a root canal to be sealed.

16. If the dental profession cannot learn to operate on the six anterior upper single-rooted teeth presenting with vital pulps in such a manner that a healthy root end will be maintained in a high percentage of cases we have no grounds on which to justify root canal work. Let us begin at this point and prove our grounds.

In the writing of this paper, I have purposely and definitely kept away from an extensive presentation and discussion of histologic, bacteriologic and pathologic details. I believe, however, that each operator should have a sufficient knowledge of these subjects to clearly understand their relation to, and influence on pulpless tooth problems. With that idea in mind, I have appended a list of articles written by men whose ability and judgment are safe guides. In the selection of these articles and authors, I in no way mean to exclude from consideration the numerous writings of other men or to imply by omitting them from this list, that they are not worthy contributions to dental literature and science.

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Fig. 34.—Large reamers.

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DISCUSSION

Alfred Walker, New York City: I wish to take exception to some of Dr. Hall's methods. The rubber dam is one of the best aids ever placed at our disposal. There can be no compromise as to its use when the maintenance of cleanliness is imperative. General surgeons are employing it in some of their operations. I cannot conceive of any tooth that is savable where we cannot use the rubber dam. As to the use of chemicals, I am less emphatic, but I do believe that certain chemicals, judiciously used, are a distinct aid in the root-canal therapy. I believe that we can prepare canals better with the intelligent use of chemicals than we can without them. As to the cementodental junction, that appears to be a very elusive point. I noticed in Dr. Hall's slides that some of those guttapercha points were right up to the apex. Some were a little short. I have had some experience with this method of filling. In 1912, it was suggested that I try it, and I did for about three years. It may have been faulty technic on my part, though I was extremely careful, but my percentage of successes was very discouraging. It has been my observation, in my own work and the work of others who are careful operators, that the percentage of reinfections in teeth overfilled is less than in those underfilled. Am I correct, Dr. Hall, in my understanding that you do not use the plain broach?

Dr. Hall: Yes.

Dr. Walker: I think it is one of the most valuable of root-canal instruments. However, its successful usage is a question of technic. Perhaps Dr. Hall can get along without it very well. I cannot. I find it is a very valuable aid, because, in the use of reamers and files, no matter how careful we may be, we may block the canal with débris, and the plain broach is a great aid in helping to keep the canal open by alternating its use with that of the files and reamers.

Dr. Hall: I agree with Dr. Walker in the universal use of the rubber dam with the exception of those few cases in which I say that it is contraindicated, and I will leave it to any of you as to whether my position is correct. There are cases of anterior post crowns in my practice, with defective root-canal fillings to be done over. The labial border of that root has been cut below the gingival line of vision. There is a good gingival attachment up to the end of that preparation. How are we going to put a rubber dam on that root without first cementing a mental band in place? And when we place a metal band what are we going to do to the gingival attachment? I maintain that we can put cotton rolls under the upper lip and under no condition do we allow saliva to enter the tooth. I do not want saliva to get into the tooth, but I certainly do not want to destroy the gingival attachment to that root by shoving a metal band over it on which

I can fasten the dam. I am glad that you spoke about some of those roots that were filled, even to the apices. Nearly every one of those, if you remember, were second attempts, and one or two of the molars had been poorly filled for thirty-five years before we did them over. Frankly, when we are doing over an old root-canal filling, it should generally be filled flush to the end of the root, because, in such teeth, we usually have necrotic tissue in the root end of the canal. The effort to stop at the cementodental junction applies to those teeth in which vital tissue still exists in the root end. Histologic evidence justifies the belief that there will be a deposition of a cementoid tissue in such apical areas if the tissue is left vital and we then have a physiologic sealing of the root end. Of course, it is impossible to determine exactly where the cementodental junction is: we simply said at or near, and if we go to about 1 mm. of the end of the root, we will approximate the junction. When we are doing over old defective root-canal fillings, we intend to go flush with the apices of the tooth as explained above when we find no vital tissue in the root end.

A Member: I should like to ask Dr. Hall how he could safely fill the tooth that had a good, normal root, especially if it were an old case, not like one in which the nerve had to be killed for some reason, and could be extirpated, and the doctor could safely feel that he could make the canal aseptic? And how can we feel with safety that this root canal is clean and has not any microscopic pathologic remnants left in it? We have had cases in which it seemed that the roots and the dressing were clean, and we find parts of the tissue remaining. How can we avoid this unless we use chemicals to remove the débris in the pulp chamber to assure a perfectly safe case?

Dr. Hall: As the title of my paper would indicate, I restricted myself to mechanics or technic. We do not attempt to handle these cases without therapeutic agents, but we do not use the old "classic remedies," the heroic tissue-destroying germicides. We maintain and can prove that we can sterilize the dentin of a tooth with other than sulphuric acid, sodium potassium paste, formocresol, etc. In our selection of drugs to be used in root-canal work, we have chosen those which most nearly approach the ideal antiseptic. By that, we mean drugs that inhibit the growth of bacteria with the least possible irritation to the adjacent vital tissue cells. I believe that, at the present time, the agents most nearly meeting these requirements are those in the halogen group, particularly the chlorins and iodins, when used in proper solutions or dilutions. I am sure that fragments of pulp tissue and other organic débris should be mechanically removed by filling and curettement rather than by chemical means. I am perfectly willing to tell you what we do with every case, but we do not have time for that.

Dr. Walker: I wish to show how the condition Dr. Hall described may be handled very easily. As a rule, the operator who makes a careful root preparation for a crown will not slight the root canal operation. If we do meet with such a condition, a tight fitting band of 31-gage German silver may be made in about five minutes. Having fitted it tightly, so that it will not have to be forced beyond the soft tissue attachment, we place it on the root and the dam is slipped over it. No cementing is necessary. We then paint around the face of the root with Callahan varnish and proceed with the operation.

A Member: I wish that Dr. Hall would tell us whether he has kept records, and what percentage of freedom from reinfection is observed, and through how many years, and in how many cases.

Dr. Hall: I have more than 1,000 carefully tabulated case records of my own. I have had as high as sixty-three root canals under treatment at one time in my office. That is the highest we ever counted and kept track of as far as the number being treated at any one time. We have tabulated case records running through a period of seventeen years. I believe that I am justified in saying that whenever recovery takes place, just as Dr. Hatton has said, whenever we get a recovery as demonstrated in the pictures that I have shown you, it persists indefinitely. As to exact numbers and percentages, it is quite a task to keep the tabulations, and my tabulations are not up to date. However, since I have stopped using heroic tissue-destroying drugs, my percentage of healing and my percentage of successful results are much higher than they ever were. I would like to stress what Dr. Walker and Dr. Cahn both suggested: let us give nature a chance. Whenever we have had recovery of diseased tissues, it was based on biologic principles, and

the vital resistance of the patient and not the result of, but in spite of, the heroic therapy used. I do not believe in so-called "incapsulation." I don't believe any semi-liquid material can be forced through the foramen and come back over the root end, to seal or incapsulate a root that is denuded of its periodontium. When I believe a root to be denuded of its peridental membrane. I extract that tooth in my office.

A Member: I would like to ask Dr. Hall whether he can give us any information at all as to how to determine to what extent the peridental membrane may be affected.

Dr. Hall: That, as Dr. Walker well knows, is the most difficult diagnostic point in the whole category of determination. In cases in which supporting structures have been destroyed, it is difficult to determine whether apical cementum is denuded or not, because, of course, the periodontal membrane does not show in a roentgenogram, and until resorption of the root end takes place, it is impossible definitely to determine. Here, indeed, intelligent diagnostic and prognostic ability must be exercised. The extent of involvement in the more accute or subacute cases is not so detrimental as is the duration for a long time in cases of chronic involvement. If all other factors are favorable and the root end, by comparison with an analogous tooth in the same mouth, shows no sign of resorption, root-canal treatment may be attempted and the tooth kept under observation.

Theodor Blum, New York City: Am I privileged to change my mind? When Dr. Hall spoke of root-canal therapy, I did not say a word, because it is not my field. I have always believed that the devitalized tooth should be treated if the root-canal therapist can take care of it, and if the general condition of the patient permits it. I also believe that, in addition to root-canal therapy, in certain cases, root amputation is indicated. And I know that it is indicated in spite of the fact that none of us have enough proof to say that the tooth has been put into a condition which is for ordinary purposes normal. When Dr. Hall says he thinks a tooth should be taken out, and he thinks this should be done, and that should be done when it comes to root amputation, I cannot agree with him. I believe that he has just as much proof as to the value and the efficiency of his root canal treatment as I have of the efficiency and success of root amputation. And I think it is entirely wrong to say that a tooth, just because, according to his findings, the apex is denuded, has to be extracted. If you remove the diseased part of the tooth which is the denuded apex, the tooth is, as far as our knowledge goes today, just as good as if he had a normal apex of an ordinary devitalized tooth which had been well treated by his or Dr. Walker's or anybody else's method of root-canal therapy. Therefore, I believe that Dr. Hall has not made one single statement which can contradict my statements as I have made them now, and which would change my mind as to continuing with root amputations; and as far as root amputation is concerned, it is the best and most nearly ideal operation that we have in mouth surgery.

Dr. Hall: It is undoubtedly true that, in many cases of patients with high resistance and the root resection well done, we find the laying down of a cicatrix or a connective tissue scar over the resected root end, and if we could be sure of accomplishing that result every time, it would be quite a satisfactory operation. In the majority of cases in which root resection is necessary because of denuded root ends, the teeth have gone through a prolonged period of disease, and there has been a more or less extensive involvement of apical and periapical tissues. Now when we remove the denuded end down to a vital cementum and pericementum, we still have dentin with degenerated and necrotic cytoplasm. The natural covering of a root is cementum and pericementum, and I cannot agree with Dr. Blum when he says that if you remove the diseased part of the tooth, which is the denuded apex, the tooth is just as good as if we had a normal apex of a tooth well treated by my method of root-canal therapy or Dr. Walker's or anybody else's. Now as to proof of the value and efficiency of correct root-canal treatment as compared with successful root amputation: many histologists have found specimens of well filled pulpless teeth in which the apical foramina have been closed or physiologically sealed by the laying down of a cementoid tissue, and such teeth are, I believe, more innoxious than teeth with vital pulps but having cavities or cavity restorations. As far as I know, no histologist has ever found a resected root end over which there was the deposition of

a cemental tissue with pericemental covering. Dr. Blayney reported one case in which he found a few lines of cemental deposits on a resected root end that seemed to follow dental tubules containing cytoplasm sufficiently normal or vital to be compatible with living tissue. Dr. Orban has found some remarkable specimens of teeth which had been fractured *in situ,* in an accident, the pulps remaining vital. In time, the fractured ends moved away from the teeth and a cemental tissue was laid down over the fractured ends of both teeth and fragments. That represents a physiologic healing; a complete reestablishment of functional relation of all tissues involved. I have never seen such a recovery in a root resection, but instead the type of healing associated with a foreign body, which is based on tissue toleration. When cases are carefully selected and a root resection is well done, they may give service with comfort for a considerable time, but on a basis of toleration and not on a basis of physiologic healing. I have records of quite a number of cases running through a period of years in which the root canals had evidently not been filled to the end of the root, and the irritation of toxic and septic diffusions from the unfilled root end caused nature to perform a root resection by a resorptive process up to a point where the root filling made conditions compatible with living tissue requirements, and there the resorption stopped. I have several such cases of which I have kept records running through a period of years, one for seventeen years, in which time there has been no further change in the root ends as far as I can determine. I feel sure that Dr. Blum does a real service to his patients in his root amputations. I believe that Chalmers J. Lyons of Ann Arbor does beautiful root resection, but Dr. Lyons has a host of young Americans of college age, coming from homes where they are well nourished, the most desirable case risks in the world. But, gentlemen, there are not enough Dr. Blums and Dr. Lyons. My opinions are necessarily based upon clinical experience and observation, and upon that basis, it seems to me the results in too many cases do not justify the operation in general practice, especially in these days of more successful partial dentures and removable types of restorations. I am not condemning men who do root resections. I am sure you will grant that I qualified my statements by saying "in my practice." My experience with them has been such that I remove the teeth rather than resect the root ends.

Dr. Blum: The lack of success in the cases that came under his observation is due to the fact that they were handled by men who do not know how to do an amputation, and who do not select the proper cases. I have done exactly what Dr. Hall has done. I have cases of root amputation going back at least twelve years, in which roentgenograms have been taken every year in order to check up. I can say offhand—my studies have not been completed—that probably at least 95 per cent of all those cases have been successful. That is due to the fact that the cases have been properly selected. As far as resorption of root is concerned, orthodontists will tell you that apices can be absorbed without any infection. And, of course, you must expect the same thing in the cases of a similar nature.

Lester R. Cahn, New York City: As far as the histologic examination of root ends of amputated teeth is concerned, all the patients that I have seen that have had root amputation won't part with their teeth. I think that is fairly good evidence that the operation has been somewhat successful. Dr. Hall said the operation is transient. What do you mean by a transient operation?

Dr. Hall: I mean that owing to biologic "factors of safety," these resected roots are tolerated for varying periods of time according to the type of tissue formed and the vital resistance of the patient. I may be all wrong, but the repair that takes place about a resected root end does not seem to be a physiologic healing, the complete restoration of functional relation between the several tissues involved, as can be demonstrated in histologic specimens. I agree with Dr. Blum's statement that many failures in root amputations are due to improper selection of cases and unskilled operators.

Dr. Cahn: I can only say that clinically the only evidence which we have that the root canal therapy is successful is the cementoid tissue. I examined a tooth that was extracted from Dr. Blum's mouth twenty years ago. There was a deposition of what looked like cementoid tissue over the apex of this tooth. Whether it was cementoid tissue or a bony growth I do not know. But it looked like cementum. There were cementoblasts present. I have a section of the

tooth. There is something over the root end that looks anatomically like cementum. But the majority of patients, as I say, won't part with teeth that have undergone root amputation. They have had one operation and they do not want another one. The chances are that if we have roentgenographic evidence of alveolar regeneration, we have to take it for granted that those teeth are fairly healthy.

A SPECIFICATION FOR DENTAL AMALGAM ALLOYS: A REPORT TO THE SCIENTIFIC FOUNDATION AND RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION*

By N. O. TAYLOR, Ph.D.,† Washington, D. C.

THE cooperative research program now in progress at the National Bureau of Standards under the joint auspices of the Bureau and the Scientific Foundation and Research Commission of the American Dental Association has as one of its projects the development of specifications for certain types of dental materials.

The accompanying tentative specification for dental amalgam alloys is the first item to be presented under this project because of the fact that more data were available on this particular type of material than on any other and that Federal Specification Board requirements for this type of material had previously been established. This new specification is based largely upon Federal Specifications Board Specification No. 356 for dental amalgam alloys and differs from it only in minor details. The facts which have served as aids in its preparation are:

1. Federal Specifications Board, Specification No. 356, the United States Government master specification for dental amalgam alloy, has been in effect since March 1, 1926, and it is believed has functioned very satisfactorily in relation to government purchases of alloy since that date. It has been the only definite standard for amalgam alloys proposed or adopted by any organization until the attached specification was approved by the Research Commission.

2. Questionnaires to representative members of the dental profession asking trade names of satisfactory amalgam alloys gave in reply names of alloys which met the Federal requirements in approximately 90 per cent of the total number of replies. This indicated that the provisions of the specification were in line with the desires of the profession.

3. Replies to questionnaires by dentists have listed the following properties as important and desirable in the order

*Report approved by the director of the Bureau of Standards of the U. S. Department of Commerce.

*Cooperative Research by the National Bureau of Standards and the American Dental Association.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

†Research Associate for the American Dental Association, National Bureau of Standards.

named: (a) freedom from permanent shrinkage; (b) freedom from large contraction at any time; (c) freedom from flow in the mouth; (d) reasonably high crushing strength; (e) ability to take and retain a polish; (f) reasonably high tensile strength; (g) freedom from tendency to blacken hand or mortar.

The provisions of the specification were selected with the aim of including the items listed above, limitations being set which seemed practical in the light of the available data on amalgam alloys.

4. A survey of amalgam alloys conducted in 1928 by your research associate at the National Bureau of Standards indicated that a large proportion of the alloys offered the profession at that time did not meet the requirements of the federal specification,[1] and raised a most important question regarding the suitability or advisability of using much of the material offered the profession. There can be no question about the profession using all brands of alloys offered, for if a brand did not find ready sale, it would be withdrawn (or perhaps "popularized" until it would sell).

A similar study including a larger variety of alloys was made in 1929. The results of this survey are given in Table I, which lists the physical properties of the alloys studied. No determinations of chemical composition were made, as the 1928 survey had indicated that all alloys whose physical properties complied with the specification met the chemical requirements in every detail.

The list of alloys studied in 1929 includes all those studied in 1928 with the exception of "gold white alloy," formerly marketed by the Harvard Company but which is no longer manufactured, and "Spencer alloy," manufactured by E. R. S. Brewster, which is now labeled "For model work only."

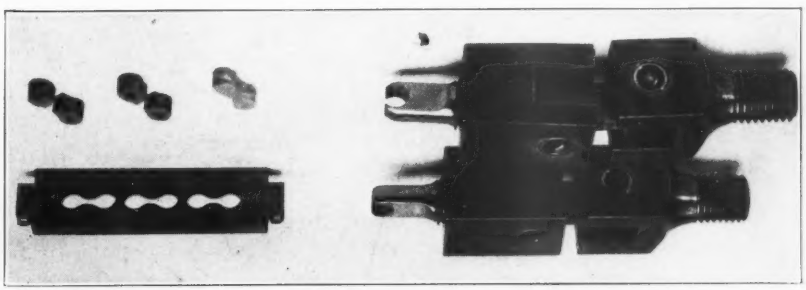

Fig. 1.—Molds, grips and samples as used in the determination of the tensile strength of amalgam alloys.

One of the most interesting of the alloys tested for the first time in 1929 is Richter's gold and platinum amalgam (No. 27, Table I). This alloy is sold in weighed tablets and weighed portions of partially amalgamated material. The manufacturer claims that this method of packing eliminates excess mercury in the final filling and also any possibility of mercury poisoning for the patient. Its efficiency in the latter respect is discussed in another paper but its properties have

1. Taylor, N. O.: A Survey of Amalgam Alloys, J. A. D. A., 16:590 (April) 1929.

been included in the list of amalgams studied. Mixed as directed in a special mechanical mixer, the resulting mass has considerable excess mercury, more, in fact, than would normally be used in hand or mortar mixing. The resulting alloy when packed shrinks badly and shows a negligible resistance to flow under pressure.

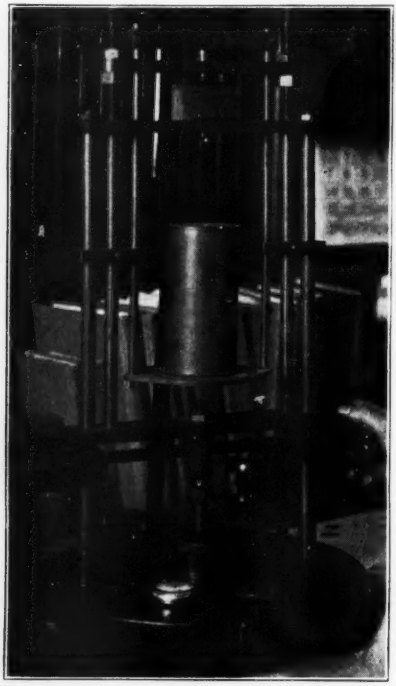

Fig. 2.—Instrument for determining brinell hardness of small samples.

The method of packaging is a patented one, and rights to manufacture or prepare alloys under it have been offered for sale in this country. It is difficult to see where the process could be used to advantage since the use of the tablet form requires some binder and that, in turn, a washing fluid for its removal. The preamalgamated portions are sealed in glass tubes and are not free from oxids. Mechanical mixing would not improve the properties of the product.[2]

A consideration of the data obtained in 1929 (Table 1) shows that eighteen of the forty-four alloy samples purchased meet the requirements of the federal and the attached American Dental Association specifications. Four alloys fail to meet the requirements for flow, and twelve alloys fail to have the proper setting characteristics. One alloy has unsatisfactory flow and setting characteristics, while nine alloys fail to meet any of the requirements. Table 2 presents a comparison of the results of the surveys made in 1928 and 1929.

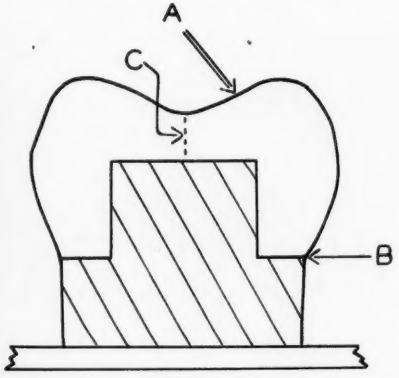

Fig. 3.—Tension in amalgam fillings. A force acting at *A* tends to rotate the filling at *B*, causing tension at *C*.

Further consideration of the tabulated data shows that several manufacturers have improved the quality of their products since the 1928 survey of amalgam

2. Taylor, N. O.: Mechanical Amalgamation: Progress Report of Research on Dental Materials, J. A. D. A., 16:583 (April) 1929.

TABLE I.—PHYSICAL PROPERTIES OF AMALGAM ALLOYS*

Sample No.	Brand	Manufacturer	Contraction to First Minimum	Total Change in 24 Hours	Flow—% in 24 Hrs. 250 Kg. per Sq. Cm.	Crushing Strength Lb. per Sq. In.	Directions			Remarks
							Proportions Alloy to Mercury	Mixing Time		
			Microns per Cm. or Parts per 10,000					Mortar Min.	Hand Min.	
1	Alba	S. S. White	−19.0	−19.0	11.5	34,000	8–7	3	1–2	Wet mix; coarse, sandy; considerable blackening
2	Argentum†	Hammond Dental Mfg. Co.	− 0.0‡	+ 4.0	3.0	42,900	None	None	None	Used 5-7; rather dry; very clean
3	Banner	Goldsmith Bros. S. & R. Co.	− 2.0	+ 4.0	7.5	36,800	None	None	None	Used 5-8; very slow to amalgamate
4	Blue Ribbon (Sh) §	J. Bird Moyer	−10.5	− 9.5	7.0	35,800	None	None	None	Used 5-5; slow to amalgamate; slight blackening
5	Brewster (M)†	E. R. S. Brewster	− 1.0	+ 1.5	1.5	51,200	None	1	2	Used 5-8; clean
6	Brewster (Q)†	E R. S. Brewster	− 0.5	+ 2.0	1.5	50,900	None	1	2	Used 5-9; clean
7	Certified†	Lee Smith and Sons	− 0.5	+ 2.5	4.5	40,700	7–9	2	#	Considerable blackening
8	Colonial	S. H. Reynolds Sons Co.	− 0.0‡	− 0.5	3.0	44,400	6–8	1–2	#	Clean; slightly spongy
9	Crandall's non-zinc¶	Cleveland D. Mfg. Co.	− 2.0	+ 2.0**	9.5	38,500	10–12	#	#	Considerable blackening
10	Crescent	I. Stern-Mizzy, Inc	−37.0	−37.0		28,100	None	None	None	Used 5-5; considerable blackening
11	Dee Alloy†	Thomas J. Dee Co	− 2.0	+ 2.0	5.0	41,300	None	None	None	Used 5-8; clean
12	Diamond Edge†	Young-Baker Co	− 1.0	+ 5.0	4.5	43,000	None	None	None	Used 5-8; clean
13	Excellent	Amalgamated D. Co., Ltd.	−21.0	−18.0	††	21,200	6–4	None	None	Slow to amalgamate; dry, clean
14	Fellowship (M)¶	Dental Protective S. Co.	− 1.5	− 2.0	3.0	39,600	5–7	None	None	Clean
15	Gibraltar (M)	A. P. Fox Specialty Co.	− 1.5	− 1.0	3.5	43,400	None	None	None	Used 5-8; clean
16	Gold and Platina	John Hood Co	−25.0	−25.0	††	20,700	None	None	None	Used 5-5; sandy; very dirty
17	Gold White (M)	A. P. Fox Specialty Co.	− 1.0	− 0.5	2.0	43,000	None	None	None	Used 5-7; very clean
18	Gold White	N. K. Garhart	−71.0	−71.0	††	27,600	None	None	None	Used 5-5; considerable blackening
19	Halloway's White	I. A. Halloway	−25.0	−23.0	11.5	31,700	None	None	None	Used 5-7; excess mercury; clean

TABLE I.—PHYSICAL PROPERTIES OF AMALGAM ALLOYS—*(Continued)*

Sample No.	Brand	Manufacturer	Contraction to First Minimum	Total Change in 24 Hours	Flow—% in 24 Hrs. 250 Kg. per Sq. Cm.	Crushing Strength Lb. per Sq. In.	Directions			Remarks
							Proportions Alloy to Mercury	Mixing Time		
			Microns per Cm. or Parts per 10,000					Mortar Min.	Hand Min.	
20	Harper's (Q)	William E. Harper	− 5.0	− 7.0	3.5	41,800	10–20	3	.....	Very thin mix; blackens mortar slightly
21	Minimax 178†¶	Minimax Co.	− 0.0‡	+ 6.0	2.5	46,800	None	None	None	Used 5-8; clean
22	Minimax 183	Minimax Co.	− 3.0	− 2.0	2.5	47,700	None	None	None	Used 5-7; clean
23	Mynol	Mynol Chemical Co.	− 6.5	− 7.0	4.0	39,800	7–9	#	.....	Difficult to mix as directed; clean
24	Ney-Aloy†¶	J. M. Ney Co.	− 1.0	+ 2.0	2.5	46,000	7–9	None	None	Clean
25	Odontographic (M)	Odontographic Mfg. Co.	− 7.0	− 8.5	4.5	39,900	5–7	.....	#	Clean
26	Pearlol	Wildberg Bros. S. & R. Co.	− 4.0	− 2.5	4.0	45,400	None	None	None	Used 5-7; clean
27	Richter's Gold and Platinum Amalgam	Deutsche Gold und Silver Scheideanstalt	−32.0	−32.0	††	‡‡	.....	.....	.....	Special mechanical mixer; excess mercury; very dirty
28	Royal (M)	N. K. Garhart	− 3.0	− 3.0	3.0	46,200	#	3	.....	Used 5-7; slow set, very slight blackening
29	Royal (Q)	N. K. Garhart	− 4.0	− 3.0	3.0	44,200	#	3	.....	Used 5-7; slow set; very slight blackening
30	S-C (M)† ‡‡	Stratford-Cookson	− 0.5	+ 1.5	2.5	42,400	5–7	#	.....	Difficult to mix as directed; clean
31	S-C (M-Sh)†	Stratford-Cookson	− 0.5	+ 2.5§§	2.5	41,700	5–7	#	.....	Difficult to mix as directed; very clean
32	S-C (Q)†	Stratford-Cookson	− 0.0‡	+ 3.5	3.0	43,900	5–7	#	.....	Difficult to mix as directed; clean
33	Silverloy	Crescent D. Mfg. Co.	− 1.5	+ 2.5	6.0	41,400	None	None	None	Used 5-8; very slow to amalgamate
34	Standard	Eckfeldt and DuBois	−30.0	−30.0	38.5	26,700	6–5	#	.....	Considerable blackening
35	Trucast†	Trucast Mfg. Co.	− 0.5	+ 1.5	3.5	43,700	None	None	None	Used 5-7; clean

TABLE I.—PHYSICAL PROPERTIES OF AMALGAM ALLOYS—*(Continued)*

Sample No.	Brand	Manufacturer	Contraction to First Minimum	Total Change in 24 Hours	Flow—% in 24 Hrs. 250 Kg. per Sq. Cm.	Crushing Strength Lb. per Sq. In.	Directions			Remarks
							Proportions Alloy to Mercury	Mixing Time		
								Mortar Min.	Hand Min.	
			Microns per Cm. or Parts per 10,000							
36	True Dentalloy "A" †.....	S. S. White.....	− 0.5	+ 3.0	2.0	43,200	7–9	2	1½	Rather dry; very clean
37	True Dentalloy (M) † ¶ ...	S. S. White.....	− 0.5	+ 1.5	3.0	45,300	7–9	2	1½	Dry mix; crumbly, clean
38	True Dentalloy (M-Sh) †...	S. S. White.....	− 2.0	+ 1.5##	4.5	40,400	7–9	2	1½	Rather dry; clean
39	True Dentalloy (Q) †‡‡....	S. S. White.....	− 0.5	+ 2.0	2.5	46,600	7–9	2	1½	Dry mix; very clean
40	True Dentalloy (Q-Sh) †...	S. S. White.....	− 1.5	+ 1.0¶¶	4.0	42,600	7–9	2	1½	Rather dry; clean
41	Twentieth Century ††¶.....	L. D. Caulk Co.....	− 0.0‡	+ 4.0	3.0	46,000	5–9	#	.....	Very slight blackening
42	Twentieth Century (Sh)....	L. D. Caulk Co.....	− 0.5	+ 1.0***	6 0	44,200	5–9	#	.....	Slow to amalgamate; very slight blackening
43	White (Sh).....	J. Bird Moyer.....	−15.0	−15.0	12.0	31,400	None	None	None	Slow to amalgamate; used 5-5; very slight blackening
44	White Gold and Platinum..	Minimax Co.....	− 1.5	0.0	4.0	47,200	None	None	None	Used 5-7; clean

*Samples purchased in the open market after June 15, 1929. Volume changes reported to nearest one-half micron; flow to nearest one-half per cent; crushing strength to nearest 100 pounds; packed exactly as directed when directions were available.

†Properties found to be satisfactory in 1929.

‡All alloys showed a slight initial shrinkage.

§Q, quick setting; M, medium set; Sh, shavings.

#For an indefinite time or indefinite proportions.

¶Alloys whose properties were considered satisfactory when rated against Federal Specification No. 356 in 1928.

**Values for other samples of same alloy show change in twenty-four hours ranging to —1.0 μ per centimeter.

††Samples failed during flow test.

‡‡No determination made of crushing strength.

§§Values for other samples of same alloy show change in twenty-four hours ranging to +0.5 μ per centimeter.

##Values for other samples of same alloy show change in twenty-four hours ranging to —0.0 μ per centimeter.

¶¶Values for other samples of same alloy show change in twenty-four hours ranging to —1.5 μ per centimeter.

***Values for other samples of same alloy show change in twenty-four hours ranging to —0.5 μ per centimeter.

alloys was published. In some cases, the improvement has not been quite great enough to cause the materials to meet the attached specifications, but the change indicates the willingness of these manufacturers to produce alloys of good quality, and it is hoped that they will be able to guarantee that their products will meet the specification in the near future.

Another item of interest is the difference in behavior of alloy filings and shavings. In the cases in which filings and shavings of the same brands were tested (Alloys No. 30, 31, 37, 38, 39, 40, 41 and 42 in Table I), it seems evident that incomplete or so indefinite as to be of doubtful value.

Determinations of tensile strength and brinell hardness were made on all of the amalgam alloys studied in 1929. The determination of tensile strength was carried out on samples of amalgam packed in small briquette molds.[3] The resulting samples were one-quarter inch thick and one-fifth inch wide at the narrowest point, having a cross sectional area of approximately 0.05 (one-twentieth) square inch. (Fig. 1.) Five days after packing, they were subjected to tension in a hand operated Amsler testing machine of 600

TABLE 2—COMPARISON OF DATA ON PHYSICAL PROPERTIES OF AMALGAM ALLOYS BASED ON SURVEYS IN 1928 AND 1929

Physical Properties Determined as	In 1928	In 1929
All satisfactory	6	18
Flow excessive; others satisfactory	2	4
Setting changes alone unsatisfactory	7	12
Flow and shrinkage excessive	6	1
None satisfactory	5	9
Total	26	44

the grinding action necessary to break down the shavings, together with the increased time necessary to secure thorough amalgamation, has resulted in the absorption and retention of larger than normal amounts of mercury. The presence of this excess mercury is evidenced by a tendency toward shrinkage during the setting period and by larger values for flow in twenty-four hours.

Directions for proportioning and mixing were entirely absent in many cases, and, in those cases, when directions were given, they were in every case inaccurate,

pounds capacity, the load being applied at approximately 200 pounds per minute, the temperature being between 20 and 25 C. The values reported for ultimate tensile strength of the amalgam alloys were obtained by averaging the values obtained in tests of three samples of each material.

The values for an individual material were found to vary over a considerable range. It was difficult to amalgamate the large samples used in a reasonably

3. Ward, M. L.: American Textbook of Operative Dentistry, p. 497.

short time, and the shape and size of the cavity used were such that the material had to be packed very rapidly. The latter factor required the use of condensing instruments with larger faces than those used in packing other test samples and, as a result, the values obtained for tensile strength are presumably lower than would be obtained if smaller samples and instruments could be used, but they do serve to compare the abilities of various types of amalgam alloys to resist tension.

Brinell hardness values of the alloys studied were determined by the use of the baby brinell hardness testing machine described by R. L. Coleman.[4] (Fig. 2.) The indentations were produced by a hardened steel ball 1.6 mm. (one-sixteenth inch) in diameter under a dead load of 12.8 kg. They were measured after projection on a ground glass screen in a calibrated metallographic microscope and camera set up. The values reported are the average of six tests on samples one-fourth inch thick.

Table 3 lists these physical properties of the alloys studied in 1929.

TABLE 3.—TENSILE STRENGTH AND BRINELL HARDNESS OF AMALGAM ALLOYS*†

Sample No.	Tensile Strength Lb. per Sq. In.	Brinell Hardness	Sample No.	Tensile Strength Lb. per Sq. In.	Brinell Hardness
1	6,000	55	23	5,100	61
2	.....	65	24	4,300	57
3	4,600	56	25	4,100	55
4	5,300	49	26	4,900	50
5	5,600	53	27	.....	..
6	5,300	63	28	4,600	51
7	4,600	50	29	4,500	76
8	4,300	58	30	3,600	58
9	4,100	46	31	5,200	59
10	4,800	41	32	4,000	55
11	3,900	58	33	4,300	65
12	.....	56	34	5,000	39
13	3,900	28	35	4,300	62
14	3,600	44	36	4,300	47
15	4,000	56	37	4,500	48
16	5,900	36	38	3,900	64
17	4,200	51	39	4,100	46
18	4,500	34	40	2,900	50
19	4,700	43	41	4,200	59
20	5,100	68	42	3,200	60
21	4,100	63	43	5,600	44
22	5,400	68	44	4,400	60

*Alloys were proportioned, triturated and packed according to the directions of the manufacturer whenever available. Values for tensile strength are given to the nearest 100 pounds.

†The author is indebted to George C. Paffenbarger and W. T. Sweeney for assistance in preparing samples and carrying out the physical tests used as a basis for this table.

The data obtained on the tensile strengths of amalgam alloys show that:

A. The tensile strength of amalgam alloys is much lower than the crushing strength of the same materials. The tensile strengths of satisfactory high silver content amalgam alloys are approxi-

4. Coleman, R. L.: Bur. Stand. J. Res., December, 1928, p. 890.

TABLE 4.—AMALGAM ALLOYS CERTIFIED BY THE MANUFACTURERS TO MEET THE REQUIREMENTS OF THE AMERICAN DENTAL ASSOCIATION TENTATIVE SPECIFICATION FOR DENTAL AMALGAM ALLOYS DATED JUNE 24, 1929.*

Brand	Manufactured by	Will Meet All Requirements on or Before
1. Alpha	I. A. Halloway	No date given
2. Argentum	Hammond D. Mfg. Co.	Oct. 1, 1929
3. Brewster's Quick	E. R. S. Brewster	Sept. 9, 1929
4. Brewster's Medium	E. R. S. Brewster	Sept. 9, 1929
5. Certified	Lee S. Smith and Son	Aug. 15, 1929
6. Crandall's Non-Zinc	Cleveland Dental Mfg. Co.	Sept. 1, 1929
7. Dee Alloy	Thomas J. Dee & Co.	Jan. 1, 1930
8. Diamond Edge	Young-Baker & Co.	Jan. 1, 1930
9. Minimax 156	Minimax Co.	Jan. 1, 1930
10. Minimax 160	Minimax Co.	Jan. 1, 1930
11. Minimax 161	Minimax Co.	Jan. 1, 1930
12. Minimax 162	Minimax Co.	Jan. 1, 1930
13. Minimax 172	Minimax Co.	Jan. 1, 1930
14. Minimax 173	Minimax Co.	Jan. 1, 1930
15. Minimax 174	Minimax Co.	Jan. 1, 1930
16. Minimax 175	Minimax Co.	Jan. 1, 1930
17. Minimax 177	Minimax Co.	Jan. 1, 1930
18. Minimax 178	Minimax Co.	Jan. 1, 1930
19. Minimax 181	Minimax Co.	Jan. 1, 1930
20. Minimax 183	Minimax Co.	Jan. 1, 1930
21. Modeloy	Crescent Dental Mfg. Co.	Dec. 1, 1929
22. Nelms 1328	Henry Nelms and Son	Jan. 1, 1930
23. Nelms 1329	Henry Nelms and Son	Jan. 1, 1930
24. Nelms 1330	Henry Nelms and Son	Jan. 1, 1930
25. Nelms 1335	Henry Nelms and Son	Jan. 1, 1930
26. Nelms 1340	Henry Nelms and Son	Jan. 1, 1930
27. Nelms 1358	Henry Nelms and Son	Jan. 1, 1930
28. Nelms 1351	Henry Nelms and Son	Jan. 1, 1930
29. Nelms 1352	Henry Nelms and Son	Jan. 1, 1930
30. Ney-Aloy	J. M. Ney Co.	**Oct. 1, 1929**
31. Odontographic Quick	Odontographic Mfg. Co.	No date given
32. Odontographic Medium	Odontographic Mfg. Co.	No date given
33. Odontographic Slow	Odontographic Mfg. Co.	No date given
34. Pearlol	Wildberg Bros. S. & R. Co.	Dec. 1, 1929
35. S-C Quick	Stratford-Cookson	Oct. 1, 1929
36. S-C Medium	Stratford-Cookson	Oct. 1, 1929
37. S-C Slow	Stratford-Cookson	Oct. 1, 1929
38. Silverloy	Crescent Dental Mfg. Co.	Dec. 1, 1929
39. True Dentalloy	S. S. White Dental Mfg. Co.	Jan. 1, 1930
40. Twentieth Century	L. D. Caulk Co.	June 8, 1929
41. Wilkins	Crescent Dental Mfg. Co.	Dec. 1, 1929

*These certificates are made by these manufacturers on their own responsibility and are not to be considered in any way a guarantee of quality by the Scientific Foundation and Research Commission of the American Dental Association.

mately 10 per cent of the crushing strength.

B. The values for the two properties do not vary directly as might be supposed, but tend to vary inversely until the tin content of the materials becomes excessive.

C. In a general way, the tensile strength of the alloys was found to increase gradually as the value for flow increased, until the tin content of the alloy became large. The increasing tin content seems to remove some of the brittle characteristics of the material, with a consequent increase in toughness and tensile strength.

D. Values for tensile strength in general increased as the tendency toward shrinkage in twenty-four hours increased to a value in the neighborhood of 20 μ shrinkage per centimeter. The alloys meeting specification requirements for the allowable change in twenty-four hours (an expansion of from 1 to 10 μ per centimeter) with few exceptions show values for tensile strength ranging from 3,900 to 4,600 pounds per square inch.

Other things being equal, an alloy having a high tensile strength is to be preferred to one with low tensile strength, but at present high tensile strength seems to be obtained only by the sacrifice of other desirable properties. The development of materials having high tensile strength in combination with other satisfactory properties appears to be a problem which manufacturers might well assign to their research staff. For the present, it would appear inadvisable and, in fact, too complicated to incorporate a requirement for tensile strength in the present draft of the specification for amalgam alloys. If any requirement were suggested, it would of necessity be a minimum value of approximately 4,000 pounds per square inch.

The values found for the Brinell hardness number of otherwise satisfactory alloys ranged largely between 45 and 65, approximately the same range as found for soft inlay golds. It seems inadvisable to base any recommendations or specifications upon these few data on this property.

The foregoing researches are reported although they do give negative results. At the present time, they may furnish sufficient data for those interested in this subject without the necessity of repeating or duplicating the work on the alloys now available.

5. Manufacturers of amalgam alloys and dentists were asked for suggestions as to possible changes in or additions to the federal specification. The suggestions made and the disposal made of them are given below.

A. The maximum expansion in twenty-four hours which is permitted by the specification is too great. A consideration of the data available from surveys of amalgam alloy made in 1928 and 1929 showed that the limit of 10 μ per centimeter was considerably greater than that given by any commercial product studied. Increased expansion would entail the use of alloys harder to work and quicker setting than those sold at present, and it was felt that there was little danger of alloys approaching the limit coming into general use. No change was made in this item of the specification.

B. The air pressure test as a measure of adaptation was suggested for inclusion in the specification. This test was not included because (1) it is based upon unsound mechanical principles; (2) it is susceptible of manipulation, intentional or accidental, to give diversified results, a condition which would make it unde-

sirable and (3) the positive expansion requirement of the following specification embodies all of the worthwhile features of the air pressure test. The test methods are simple and more direct than the so-called adaptation test.

C. The proposal has been made that specifications for dental amalgam alloys should include tests for tensile strength. This proposal is based logically upon two conditions wherein alloys may be subject to tension.

The first instance occurs in Class II cavities, in which forces of mastication having angular components deviating slightly from the horizontal may throw the occlusal surface of the filling into tension mechanically. (Fig. 3.)

The second possibility is tension produced in the occlusal portion of the same type of filling by thermal changes. Sudden cooling of an amalgam filling which has a coefficient of expansion about three or four times that of the tooth and also much higher thermal diffusivity may result in the fracture of the filling through tension.

In order to incorporate into any specification a requirement for tensile strength which would result in marked improvement in the values as shown by the materials now accepted as satisfactory under the present specification, it would be necessary to modify our present ideas of acceptable materials and to accept alloys which would show decreased crushing strength, increased flow and, what is more important, permanent shrinkage.

Many alloys fail through lack of a property commonly known as edge strength, one of those terms used, unfortunately, to cover many things. Edge strength failures may be caused by improper cavity design and preparation, lack of adaptation of alloy in the cavity, and improper finishing of margins, or by the spherodizing of the alloy, due to thermal changes. In all these cases, the alloy is subjected to stress, sometimes to crushing loads and at other times to shearing loads which throw parts of the material into tension and others into compression, in such thin and unsupported sections that failure must result.

D. An impact strength test was suggested as an addition to the specification. Sufficient data are not available on this test at present to verify its importance as an acceptance test, and it is omitted from the specification pending further investigation.

E. The crushing strength requirements of amalgam alloys should be raised.

The better grade alloys have shown crushing strengths from 40,000 to 50,000 pounds per square inch, well above the limiting value allowed of 35,500 pounds per square inch.

It would seem that for the present at least there is little probability of the crushing strength of an otherwise acceptable material falling close to the minimum value allowed and so no change has been made.

F. The other detail requirements of the federal specification have been retained, the available data having shown that:

(1) The range of chemical compositions allowed is ample to permit further experimentation and development by manufacturers. More than half the alloys tested in 1928 met this part of the specification, while only 40 per cent of those meeting the chemical specification could fulfill the physical requirements. No alloy tested as a part of the survey met the physical requirements of the specification when the silver content was less than 66.9 per cent by weight or the tin content more than 27.1 per cent by weight.

(2) The required setting characteristics can be produced in any high quality alloy scientifically manufactured.

(3) The limiting value for flow is seldom exceeded by a high silver alloy. The average value found for the better alloys was about 3 per cent. Flow is undoubtedly undesirable, but any attempt to eliminate it completely would result in increased brittleness and decreased edge strength.

G. The general requirements have been adopted without change, as have the methods of testing with the exception of a minor variation in the method of determining crushing strength. Minor changes have been made in the sections headed "packing" and "notes," to adapt them to the use of the dental profession.

The following specification was approved by the Scientific Foundation and Research Commission of the American Dental Association at a meeting held Oct. 10, 1929, as a tentative specification for dental amalgam alloys for the guidance of the dental profession.

AMERICAN DENTAL ASSOCIATION TENTATIVE SPECIFICATION FOR DENTAL AMALGAM ALLOYS

(Approved Oct. 10, 1929)

I. *Types.*—1.—This specification is for the so-called "silver" amalgams which are to be used for restorations in the mouth.

2. The alloy may be furnished as:

Type A. Filings.

Type B. Shavings.

II. *Material.*—The comminuted alloy shall be free of foreign materials and shall be uniform.

III. *General Requirements.* — Amalgams shall possess the following features, known as satisfactory working qualities:

1. Thorough amalgamation in three minutes.

2. Absence of granular or sandy consistency when amalgamated.

3. Susceptibility to carving for at least fifteen minutes after amalgamation.

4. Susceptibility to receiving and retaining a polish twenty-four hours after amalgamation.

IV. *Detail Requirements.* — 1. Chemical Composition. The chemical composition shall be within the following limits:

Silver	65 to 70 per cent
Tin	26 to 29 per cent
Copper	3 to 6 per cent
Zinc	0 to 2 per cent

2. Ultimate compressive strength. The average ultimate compressive strength values of three or more tests shall not fall below 2,500 kg. per square centimeter (approximately 35,500 pounds per square inch).

3. Flow. Specimens subjected to a constant pressure of 250 kg. per square centimeter (approximately 3,550 pounds per square inch) shall not show more than 5 per cent flow (i.e., more than 5 per cent shortening in length of specimen) in a period of 24 hours.

4. Setting changes. Twenty-four hours after amalgamation, the length shall have increased between 1 and 10 μ per centimeter. If at any time during the test, a contraction of more than 4 μ per centimeter is detected, the alloy shall be rejected.

V. *Method of Sampling and Tests.*—The manufacturer shall specify the conditions under which test specimens are to be made, including alloy to mercury ratio, method and time of trituration and method of packing. These directions must fall within the limits of his published directions for the use of the product. The following details relative to test methods will be observed:

1. Ultimate compressive strength. Specimens shall be cylinders 6 mm. in diameter and 12 mm. long. These shall be prepared by condensing the amalgam into a cavity of these dimensions in a rigid block, using a reasonable technic (that given in the sheet of instructions accompanying the alloy).

The ends of the cylinder shall be surfaced plane at right angles to the axis. Strength tests shall be made five days after condensing, and the actual time consumed in applying the load, starting from the instant that the specimen is subjected to a load of 100 pounds, shall not be over three minutes nor under one minute. Tests shall be made at temperatures between 20 and 25 C.

2. Flow. Specimens shall be cylinders 4 mm. in diameter and 8 mm. long and should be prepared in the same manner as those for crushing. Three hours after condensing, the

specimen shall be subjected to a constant pressure of 250 kg. per square centimeter (approximately 3,550 pounds per square inch). During this test, the specimen shall be maintained at a temperature between 20 and 25 C.

3. Setting changes. Specimens shall be prepared by condensing into a cavity or matrix. These shall be removed as soon as condensation is completed and shall not be subject to restraint during the test. Measurements shall begin fifteen minutes after amalgamation (time spent in mulling and condensing to be included as a part of the fifteen minutes).

VI. *Packing.*—1. Alloy shall be packed in moisture resisting containers and in quantities of 1, 2 or 5 troy ounces.

2. Accurate and adequate instructions for proportioning and manipulation shall accompany each package.

3. Each package of alloy shall be marked with a serial number or a combination of letters and numbers which shall refer to the manufacturer's records for the particular lot or batch of alloy.

4. The date of manufacture (year and month) shall be indicated on the package as a separate item or as a part of the serial number.

5. Containers shall not be made, in whole or in part, of materials which will amalgamate readily with mercury.

VII. *Notes.*—1. Manufacturers of amalgam alloys may indicate that their materials comply with this specification by (A) a statement on the package guaranteeing the material contained therein to meet the requirements of this specification, or (B) a statement as to the chemical and physical properties of the alloy.

2. The American Dental Association will not assume responsibility for, or guarantee compliance of, materials so labeled by manufacturers, but will, in event of a dispute between a member of the Association and a manufacturer, act in an advisory capacity and will designate testing laboratories having equipment for testing dental amalgam alloys where necessary tests may be made.

Preliminary copies of this specification were distributed to the manufacturers of amalgam alloys, and they were given the opportunity to certify their willingness to produce materials meeting the requirements of the specification. Some time is necessarily required to make minor changes in packages and directions, and the manufacturers were asked to indicate the latest date on which their product would meet all of the requirements. To date, certifications for the alloys listed in Table 4 have been received.

PRINCIPLES AND ESSENTIALS OF BAR CLASP PARTIAL DENTURES*

By F. E. ROACH, D.D.S., Chicago, Ill.

A REVIEW of dental literature reveals the fact that the clasp is the oldest and, in spite of the slanderous abuse of the precision attachment advocates and other commercial interests, still is, and probably will continue to be, the most practical and popular means of anchoring partial dentures of the removable type.

Preliminary to a detailed consideration of the bar clasp, which is the primary object of this paper, I submit the following principles as being applicable to other types as well.

*Read before the Section on Partial Dentures; Crown and Bridge at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1929.

When teeth that do not need repair are to be used for anchorage, the clasp is the most conservative and efficient means of attachment.

All teeth are more satisfactorily clasped mesiodistally than labiolingually or buccolingually.

Clasps having no occlusal rests change position, thereby losing the correct relationship of the entire appliance.

When properly designed and finished, clasps do not cause mechanical abrasion or decay.

Without reciprocal bearing, clasps fail to function properly and often cause orthodontic movement.

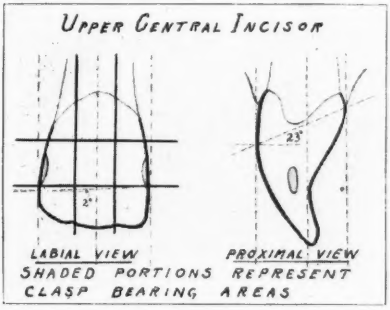

Fig. 1.

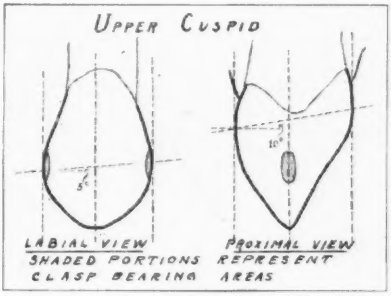

Fig. 2.

Most clasps should encompass four fifths or more of the circumference of the tooth and be kept upon the enamel.

A clasp that extends only half way around the tooth is inefficient and usually acts as an orthodontic appliance.

Specifically, the bar clasp is a more flexible, yet firm, means of retention, and permits both mesiodistal and buccolingual adjustment.

The three-point reciprocal, compensating bearing gives support, rather than causing a strain on the tooth, and permits normal functional movement.

The more nearly universal application of the bar clasp is due to its variability of design and adjustment.

The three small remote points of contact prevent interference in placing adjacent artificial teeth, minimize visibility and eliminate decay.

The bar clasp is the result of many years of concentrated effort to eliminate the objectionable features of the old type of clasp. We have now passed the experimental stage. Our only concern at this time is that the principles of application be understood and that construction be properly executed.

It may be of interest to note that my first bar clasp was made in 1905 and was worn for seventeen years. The success of this case inspired further study and experiment, with the result that since that time they have come into universal use.

The essentials in partial denture service may be summarized as follows: a careful survey; repairs, treatment and preparation; a dependable impression technic; a comprehensive understanding of the fundamental engineering principles involved in design and construction; proper installation and maintenance; a full appreciation of esthetics, physiologic func-

tion and the possibilities of pathologic sequence.

You will note that in this summary the word survey is used instead of diagnosis, which is the term commonly applied in this connection. The term survey is preferred for the reason that we are considering the mouth at this time from a structural engineering standpoint. As a preliminary, we may have occasion to make a diagnosis. For example, we may make an examination of the mouth for the purpose of determining the presence of or identifying a certain disease. This would be making a diagnosis. We should differentiate between the two terms.

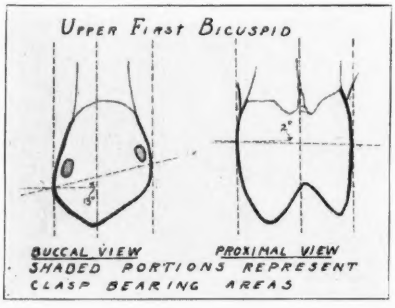

Fig. 3.

In making the survey, we note the position, condition and relation of teeth and spaces, for the purpose of determining the type of appliance indicated. In order that we may make the necessary preparation for incisal or occlusal rests, we must determine at this time the teeth to be clasped and the type of clasp to be employed.

Since we build impressions according to the class of case, it is first necessary to classify the case in order that we may determine the impression technic to be employed.

A thorough search for tooth decay should be made, indications of susceptibility or immunity being noted. The disposition of the patient regarding mouth hygiene and his attitude toward removable appliances are important factors. Age, occupation, social and financial circumstances may also require consideration at this time. In the more complicated cases, the roentgen ray and articulated models will be very helpful.

As the occlusal rest determines the relationship of saddles, clasps and articulation, all surfaces upon which occlusal or incisal rests are to bear should be prepared before the impression is taken. In this connection, I wish to emphasize the importance of these preparations. There

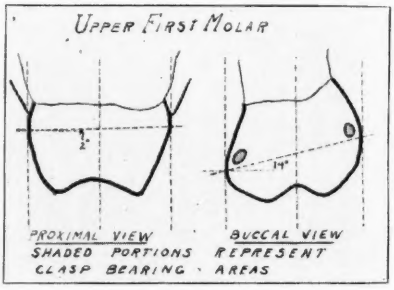

Fig. 4.

is a prejudice on the part of some operators to this practice.

Many years of experience and observation have proved conclusively that the slight grinding of the tooth as indicated in Figure 31 does no harm, and that by reducing the height of the marginal ridge, as in the case of molars and bicuspids, the occlusal rest will be stronger, less bulky and in every way better. Incisal rests are prepared as shown in Figure 17. The surfaces of all such preparations should be highly polished. Some form of rest should be employed with almost all clasps, but with the bar clasp, they are absolutely indispensable.

Of the many essentials in partial denture service, the impression is perhaps the most important. To discuss adequately this phase of the subject would require the entire time allotted to me.

Suffice it to say that sectional impressions built into the mouth according to the "draw" of the case, securing clean, sharp, well-defined sections with predetermined lines of separation, are most dependable.

Sectional impressions made with modeling compound are ideal in that we are using a material that is more acceptable to the patient than is plaster and can be kept under control at all times. With this material, it is possible to get better detail, establish the draw, and at the same time obtain compression of the saddle and palatal bar area.

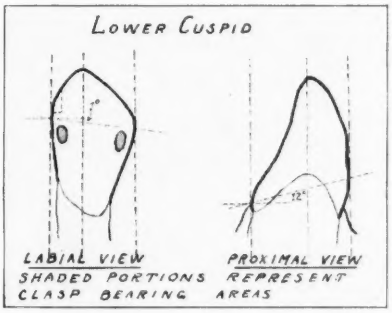

Fig. 5.

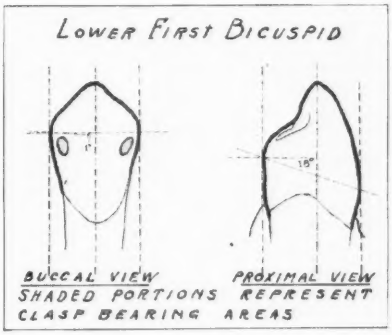

Fig. 6.

The important parts of an impression are the rest, clasp and saddle-bearing areas. The nonessentials are the undercuts between the teeth, gingival margins and areas beyond those to be occupied by the appliance. As we are casting direct, the impression of undercuts and gingival margins will be trimmed off before running the cast.

A knowledge of design guides us in the selection of materials, the type of appliance and preparation for rests, and facilitates making the impression. Design has much to do with the strength, efficiency and life of the appliance, as well as the possible damage to the teeth and mouth in general. Speech, mastication and all functions of the mouth may be seriously affected by improper design.

The all gold one-piece casting makes possible the employment of skeleton, truss-bar designs that afford great strength, with the minimum tooth and tissue covering.

Many well-designed and beautifully finished cases are ruined at the time of installation by injudicious grinding and mutilation in one way or the other or by failure to establish correct occlusion.

Great care should be exercised at the time of installation to seat the case fully and to adjust the occlusion so that the major stress of mastication will be on the natural teeth.

While esthetics may be and is considered by some a nonessential, no case can be considered a success that violates the law of harmony and "correspondence." The sum total of the whole problem is the restoration of normal masticatory condi-

tions with the least possible interference with speaking, singing and other functions of the mouth, keeping in mind at all times the damage that may result from wearing any sort of artificial appliance.

The accompanying figures were made to illustrate principles of clasping, and important features in the design and construction of cast partial dentures of the removable type. They are divided into series, the first nine constituting one group.

The source for this group is G. V. Black's "Dental Anatomy." The outlines were enlarged pantographically direct from the text, and are therefore accurate. They demonstrate the feasibility of clasping the teeth mesiodistally, and the difficulty in clasping them labiolingually or buccolingually. They also point out the ideal clasping areas, represented by the shaded portions. Note that these ideal areas lie in the middle third of the tooth incisogingivally or occlusogingivally, and in the proximal third mesiodistally.

A word concerning the treatment of these outlines will clarify the points that they are intended to demonstrate: 1. The outline was pantographically enlarged to the proper proportions. 2. The long axis of the tooth was indicated by the vertical dotted line through the center. The lateral dotted lines were constructed parallel to this long axis, so that they passed through the tooth outline at the point of its greatest convexity. Through this point on the left, a perpendicular to the long axis is represented by the short horizontal line. Finally, the two points representing the greatest diameter were connected, and the angle of variation from the horizontal was measured. In the first diagram only, in order to point out the division of the tooth into thirds, lines were constructed to facilitate localization of the ideal clasp bearing areas.

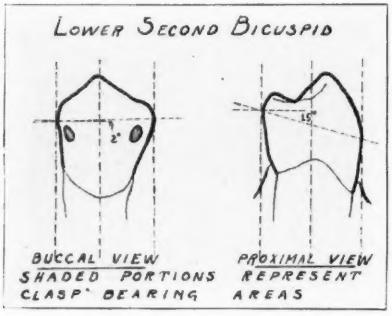

Fig. 7.

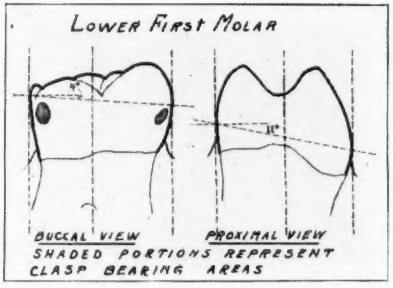

Fig. 8.

This ideal clasping area lies just gingivally from the greatest convexity of the tooth. These areas are represented by localized shaded portions.

Each illustration represents a different tooth in the arch, and each presents two views, except the last, which pictures two buccal aspects of lower third molars. On all the others, the labial, or buccal, and the proximal aspect are represented. Individual consideration will now be given to each chart.

Figure 1 is a labial and proximal view of the upper central incisor. It is axiomatic that, in clasping teeth, care should

be taken to avoid the gingival areas, particularly the labiogingival and buccogingival thirds, which are most susceptible to decay and erosion. With this fact in mind, let us consider the proximal view first, noting the distance from the point of greatest convexity incisally and gingivally, respectively, on both labial and lingual aspects. The clasping area must be gingivally from this point, and on the labial, this is possible. Consider, however, that spring tension unilaterally, as represented by a clasp on one side of the tooth, must be compensated for by reciprocal pressure opposed to it; otherwise "skoliodontic" (the reverse of orthodontic) movement is the result. Note now that the point of greatest convexity on the lingual aspect, which is the point for reciprocal pressure, is so close to the gingivae that there is no room to place a clasp arm in that position. Hence, to clasp this tooth in a labiolingual direction is impossible. The labial view on the left shows the points of greatest convexity close to the incisal edge, with ample room between them and the gingivae. It naturally follows that a mesiodistal gripping clasp is the only one that will function in this case. In this way, we also eliminate all metal in contact with the labiogingival third of the tooth, the area in which decay and other pathologic factors are most likely to occur. This feature is true of all the teeth in the human arch, generally speaking, as demonstrated in this series.

In Figure 2, the same view is presented of the upper cuspid. Let us consider the same points, in the same order as in the former diagram, i.e., the relative distance and contour in both directions from the points of greatest convexity, observing why this tooth is to a degree more favorable than the former for clasping in the labiolingual direction. There is somewhat more space for the reciprocal bearing on the lingual aspect. However, the extreme advantage as represented by the mesiodistal grip is easily seen. The clasp-bearing areas are sufficiently removed from the gingivae to preclude any thought of impingement.

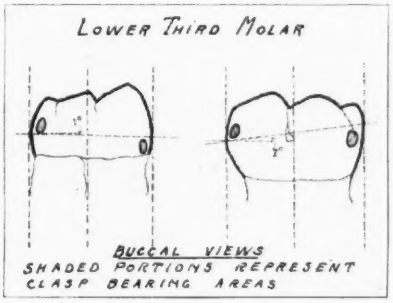

Fig. 9.

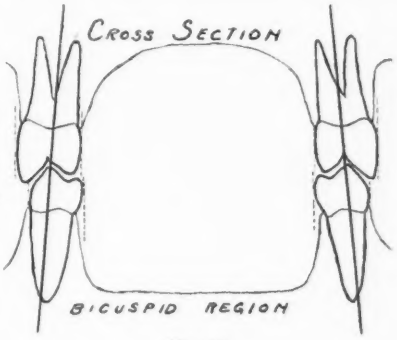

Fig. 10.

Figure 3 shows the upper first bicuspid, undoubtedly the most favorable for a buccolingual clasp. But even in this tooth, a clasp which grasps the tooth from these positions is dangerously close to the gingiva. It is evident from a consideration of the accompanying buccal view that a mesiodistal clasp is the ideal, even in this tooth.

In Figure 4, it is evident that the same condition holds true of the upper first molar. We are frequently required to clasp this tooth, and a consideration of the chart makes it evident that it is extremely impractical to attempt to do so except mesiodistally.

In Figure 5, the lower cuspid again demonstrates the impossibility of a clasping action in a labiolingual direction. The clasp, to be efficient, must grip the tooth mesiodistally.

Figure 6 shows that the lower first bicuspid is somewhat more favorable for clasping than the lower cuspid, but still brings out the point in question very forcibly.

In Figure 7, the lower second bicuspid is approximately the same, even a little more favorable than the last, but the advantages of the mesiodistal clasp are still markedly evident.

In Figure 8, the lower first molar, another tooth which is frequently clasped, presents the same difficulty, forbidding the use of the buccolingual clasp, and forcing the use of the mesiodistal to insure true function as a clasp.

Figure 9 shows the lower third molar, probably the most difficult of all teeth to clasp, owing to its irregularity of form, usually conical, and the fact that the tissue in this region is usually found to cover a great deal of the tooth surface. The reciprocal bearing, in such an instance, might rest above the point of greatest convexity. Usually, in attempting to clasp this tooth, the tissue toward the mesial aspect is absorbed over the ridge owing to absence of teeth mesially. In almost every instance, some slight undercut is available for the purpose of retention. Teeth of this description, impossible to clasp in any other way, are employed as successful retainers by the use of the bar-clasp, or one of its many modifications.

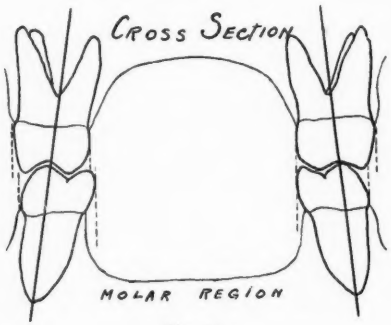

Fig. 11.

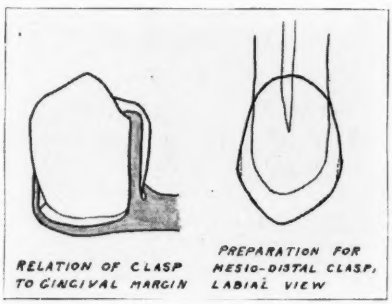

Fig. 12.

The requirements outlined by the clasping principles in these charts are fulfilled by the bar clasp and its modifications. The flexibility and great variety of modifications permit its application to almost every type of contour. Retention of a removable partial by the bar clasp is definitely assured.

Figures 10 and 11 make up the second group of charts, limited to two, cross-section views of the arch in the bicuspid and molar region. Note here the angle at which the teeth are set in the arch. This is of importance in the taking of impressions. All upper bilateral cases are

taken in modeling compound to insure compression of the saddles and palatal areas. In so doing, the gingival portion on the lingual is represented as an undercut, and is destroyed in removing the impression. The tilting of the upper teeth makes this area a small one, and can be disregarded for this reason: Clasping is done on the buccal aspect, as a general rule, and the reciprocal bearings are placed on the lingual. There is no necessity for these being below the point of greatest convexity, and hence this portion of the impression in the upper jaw is unnecessary.

In the lower jaw, the situation is reversed. The tilting of the teeth is in the opposite direction, and the lingual undercut is increased. Too much distortion would result if a mass of material were removed from this portion of the mouth, and hence the technic of taking a lower impression has been altered to meet this requirement. Both of these charts represent the undercut areas in the normal arch, and serve as a visual demonstration of the fact that mass impressions must be distorted in order to remove them from the mouth. Sectional impressions are the only solution, and the only means of faithfully recording these undercut areas. Those on the buccal aspect, particularly, are valuable as a means of retention, and must be reproduced on the cast.

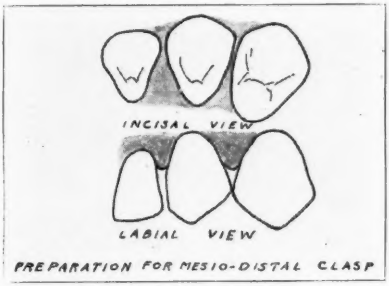

Fig. 13.

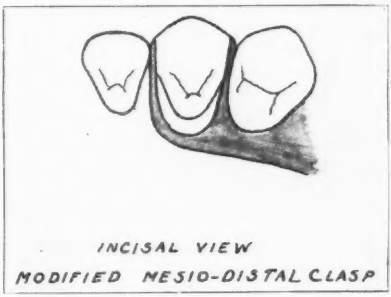

Fig. 14.

In Figure 12, the drawing on the left represents a distobuccal view of a lower bicuspid, showing the relation of various parts of the appliance to the tooth and soft tissues. Note particularly that the buccal bar rests in apposition to, but does not impinge on, the high point of the soft tissue around the tooth. Note particularly that at the point where this bar crosses the gingival margin, it is free from contact. This is shown on the diagram by the small triangular space in white between the bar and the tooth. From this view, the bar continues up and around into the proximal space. Its contact with the tooth is farther in the proximal space, and therefore not shown in this diagram.

The sketch at the right shows the small amount of preparation required for the mesiodistal two-point bearing clasp. The view is sectional, and the relative depth of the enamel is shown. Some operators object to this preparation. If it is properly done, and the new surface polished, there is no danger. It has been demonstrated that the enamel is as good part of the way through as on the natural surface, and long experience in placing this

sort of clasp has demonstrated that the preparation may be made with safety.

Figure 13 is an incisal and labial view of three teeth, the idea being to present the preparation for a mesiodistal clasp in its several stages. The labial view shows the normal contact on the distal surface, with the preliminary cut on the mesial. The incisal view shows the preliminary cut on the distal surface, and the finished preparation on the mesial. It is necessary to round off this cut preparation so that a small portion of the clasp can extend on to the labial surface in sufficient bulk of gold.

Figure 14 is an incisal view of the same preparation completed, and with a

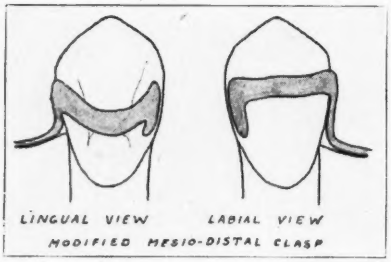

Fig. 15.

modification of the mesiodistal clasp in position. The clasp restores the contact. The modification consists of the following: Instead of connecting the mesial and distal portions of the clasp by a continuation across the lingual surface of the tooth, as is done in the ordinary mesiodistal clasp, the bar is run below the gingival margin on to the soft tissue. This modification is indicated where the bite is close, and insufficient room is presented on the lingual surface. The bar is kept away from the free margin on the gingivae.

Figure 15 presents a valuable modification of the mesiodistal clasp, indicated where it is inadvisable to make the usual preparation for the ordinary mesiodistal variety. The vertical portion of the clasp, in this case, acts as additional means of stabilization, and its direction resists a tendency of the saddle portion to tip. This clasp must be carried far into the proximal space to permit of its functioning.

In Figure 16, the sketch on the left represents a sectional labial view of a lower cuspid. The preparation indicated, an incisal rest, is a definite step prepared in the enamel. The relative thickness of enamel is shown, with the position and outline of the preparation. On the right is a sectional mesial view, to show the

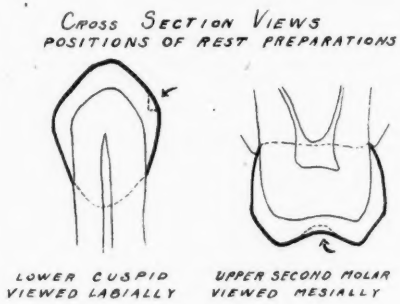

Fig. 16.

position and outline of the occlusal rest preparation. The importance of this preparation can hardly be overemphasized. This area represents the point of fixation of the entire appliance. A definite preparation is always indicated. This diagram shows its relative extent.

In Figure 17, the old type clasp is shown. This is very limited in its positional variations; practically to three, shown in this diagram. Being limited, the range of adaptability is not great, and each positional variation functions approximately the same way. Contrast this condition with the bar clasp, whose modi-

fications are unnumbered, and whose range of adaptability permits it to function under the most unusual circumstances.

In Figure 18, on the left, is shown the abutment of an extension saddle case. Note the bar clasp and its relation to the tooth and soft tissues. The dotted lines represent the occlusal rest and grooved pontic. Note particularly that the appliance is in contact with the distal surface of the clasped tooth, except over the free margin of the gingivae. Only at this portion is it free. The manner in which the tooth is clasped, and the appliance in contact, at the distal of the tooth in the undercut region, resists the tendency to tilt at the heel.

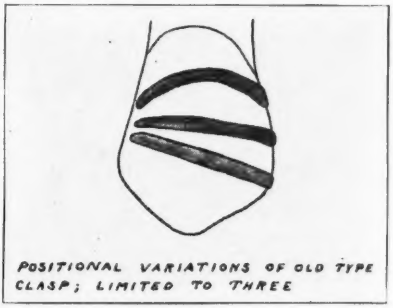

Fig. 17.

The diagram at the right shows the relative length of the bar clasp and the old type clasp. Tremendous flexibility is gained by this great length of the bar clasp, and this greater flexibility insures an appliance of longer life. At no time is the required elasticity of the metal so great that a strain is put on it; the fatigue movement is less, and longer life results.

Figure 19 is a distal and buccal view of a modification of the bar clasp. The prominent bony structure just below the free gingivae, found so often in lower bicuspid regions, is an indication for this variation. The length and elasticity of the spring action are still provided for by bringing the clasp off of the saddle distally. This modification has proved very satisfactory in a large number of cases. The lingual portion of the bar clasp is not shown, but occupies its usual position in the interproximal space.

Figure 20, left, is a common variation, constructed to eliminate any display of gold on the buccal surface of upper bicuspids. The buccal bar is terminated in the undercut at the distobuccal angle of the tooth. The lingual arm is carried into the interproximal space, so that more than

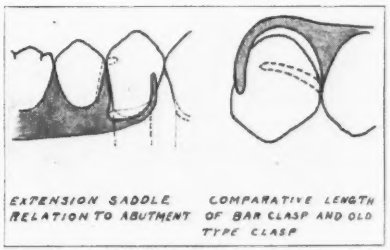

Fig. 18.

half of the tooth is clasped between the two. With the occlusal rest, the resultant of the forces is in a mesiodistal direction. The drawing on the right shows a truss bar type of appliance. The size of the bars can be materially reduced in this manner, with a greater degree of strength. Two occlusal rests are provided, and the clasp bearing is provided in the interproximal space, on both buccal and lingual surfaces.

Figure 21 is an occlusal and buccal view of another truss design, using a T-bar clasp on the molars. This modification of clasp bearing is indicated where greater stability is required than that pro-

vided by the interproximal type of bearing shown in the preceding diagram.

From a superficial survey of the proceeding diagram, and failure to apply the principles as outlined above, an appliance of this kind might be considered as indicated on a single tooth, as shown in Figure 22. Such is not the case. The grip in this case is strictly buccolingual, and the clasp bearings are not in the middle, proximal third of the tooth. The truss type appliance may be used in these cases, but the clasp bearings, instead of being T-shaped, are modified to conform to principles.

Two "reverse-action clasps" may be used here, having their bearings on the distobuccal and mesiolingual surfaces, respectively. (Fig. 23.) This method furnishes the required stabilization and provides a secure anchorage.

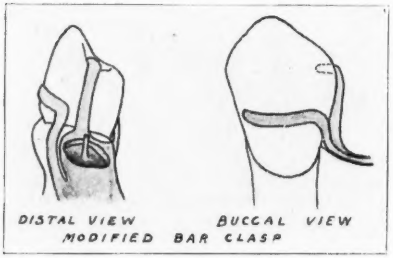

Fig. 19.

Figure 24 is a modification of the bar clasp particularly adaptable to conical teeth. As a rule, in this type of case, some undercut is present on the mesiobuccal or distolingual angle of one or both teeth. This type appliance permits advantage being taken of these minute places for retention which would otherwise be unavailable. The flexibility of the clasp-bearing bar is provided by its length, the reciprocal bearing insuring no skoliodontic movement of the tooth. This is a very valuable modification, admitting a wide range of variation in application.

The bar clasp relations to the teeth are diagramatically shown in Figure 25. The bearing is on three points, remote from each other, and the resultant of the forces is in a mesiodistal direction.

Figure 26 represents a feature of the bar clasp which permits full occlusal restoration, sometimes very necessary in narrow spaces. The old type clasp joins the appliance in the interproximal space. Some room must be left for the metal in this region and, in restricted spaces, this narrows the occlusal surface of the pontic, often making it difficult to get a tooth sufficiently narrow to fit.

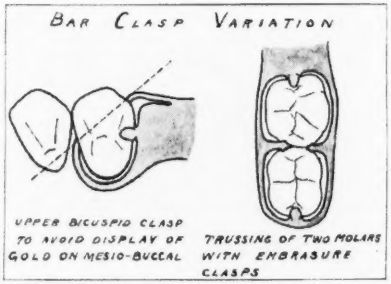
BAR CLASP VARIATION
UPPER BICUSPID CLASP TO AVOID DISPLAY OF GOLD ON MESIO-BUCCAL
TRUSSING OF TWO MOLARS WITH EMBRASURE CLASPS

Fig. 20.

The bar clasp comes from the saddle portion of the appliance, and does not interfere. The bar which attaches the occlusal rest to the saddle is the only factor to be taken into consideration, and to permit the porcelain pontic to occupy all the space represented by the occlusal rest, (Fig. 26), it is grooved as indicated in the sketch. This provides a greater bulk of material in the region of the occlusal rest, eliminating the breakage factor, and permits the entire occlusal area to be restored by the porcelain pontic. Occlusal and buccal views are presented, with

an insert of the pontic, showing its grooved preparation.

Figure 27 is intended to impress on the observer the necessity for the occlusal rest, and to point out the factors which it governs. The occlusal rest is the only unalterable, nonadjustable portion of the appliance. It goes to a definite seat, and consequently determines the relationship of all of the other parts. Alter this fixed point, and you have altered the saddle bearing area, the clasp bearing area and the occlusal relationship. The necessity of occlusal rest preparations, and the designing of cases with these essential points in mind, is the object of this sketch.

Figure 28 shows two anterior cross-sections of the lower jaw, indicating the positions which should be occupied by the lingual bar in two types of mouth. Note the undercut in the illustration on the left. The bar in this case is to be put in apposition to the soft tissue, and on the highest point of its elevation. Any settling which might occur would carry the bar into space, and not against the soft tissues. The illustration to the right is another type mouth, in which this portion is an inclined plane. The bar in this case should be set away from the tissue. In case of any settling, the bar has some room in which to settle before impinging on the soft tissues.

In Figure 29, the illustration on the left is a very important one. In the first place, it shows, in cross-section, the relation of the bar clasp to the contour of the soft tissues. The bar on the buccal side is always on the high point of elevation of the soft tissue, and never in the undercut below it, or on the free margin of the gingivae. Another point in this connection is that the bony structure underlying the palatal portion and the buccal is different. The portion on the buccal side is more or less rough, and overlaid with a thin mucosa. Should irritation from a bar clasp occur, it is usually on the buccal side. Therefore, this tissue is never compressed in impression taking.

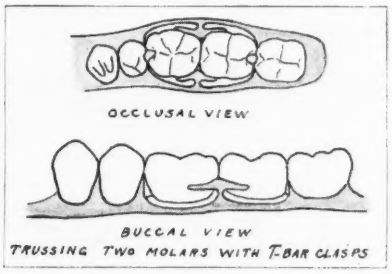

Fig. 21.

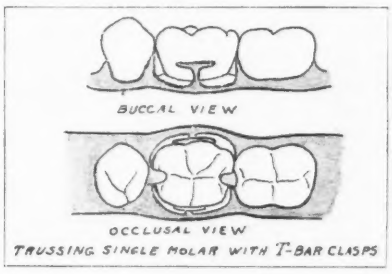

Fig. 22.

When the mucosa is unusually thin and hard, it is advisable to relieve the impression in this region.

On the palatal side, the tissue is thick and heavy, being so created by nature to withstand the stress of mastication. This is the tissue which should be compressed in impression taking, and against which the bar should rest snugly.

The diagram at the right points out the dangerous area on which to terminate appliances. They should be terminated on the soft tissue, away from the free margin of the gums, or on the hard tissue, spanning the free margin, as indicated in

the sketch. Between the two parallel lines is the dangerous area.

Figure 30, a diagrammatic representation of an edentulous maxilla, again points out the difference in the quality and distribution of soft tissue over the bony structure. It is to illustrate that the portion of a saddle which is on the buccal of the ridge does not function as such. First, the direction of the force of masti-

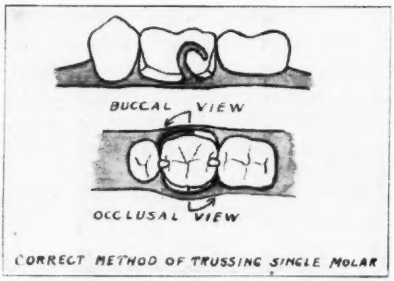

Fig. 23.

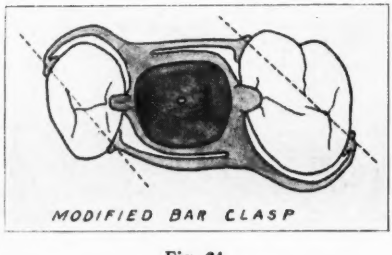

Fig. 24.

cation is parallel with and not opposed to it. Hence, it does nothing to withstand pressure from an occlusal direction. Secondly, the character of the tissue is such that it will not stand the abuse imposed by an appliance in this region. Saddles are carried just over the crest of the ridge on the buccal side, and if it is necessary to extend them to distribute the load, the additional breadth is gained on the palatal side, where the tissues will withstand the pressure.

DISCUSSION

W. I. McNeil, Chicago, Ill.: Some form of clasp has been used for many years in supplying anchorage for partial dentures. Bonwill, in his writing of the early eighties, describes a band fitted about teeth to support appliances. Dr. Roach was among the pioneers in this particular form of attachment. He has exerted much thought and labor with the hope of developing an attachment which

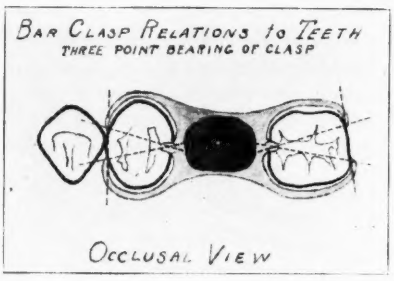

Fig. 25.

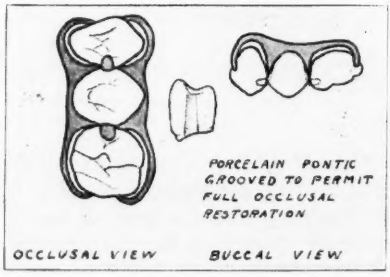

Fig. 26.

will preserve tooth structure and at the same time firmly and comfortably maintain the appliance in position. To Dr. Roach, much credit is due for the development of the clasp in all varieties and designs. It is because of his untiring efforts that we have the privilege of listening with interest to his latest addition, the bar clasp. I heartily agree that in cases in which teeth need repair in the form of inlays or crowns, it is advisable to use some other type of attachment. I also admit

that there is no form of attachment quite so satisfying as a properly designed cast clasp. These cast clasps were primarily designed to conserve tooth structure, and the fact that they have been universally adopted by the profession is sufficient evidence of their dependability, accuracy and satisfaction. All practitioners have agreed that occlusal rests are essential in the construction of any types of clasps, either wrought or cast. As brought out by Dr. Roach, occlusal rests are the stabilizing parts of the clasps without which

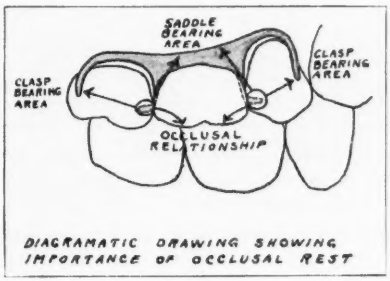

Fig. 27.

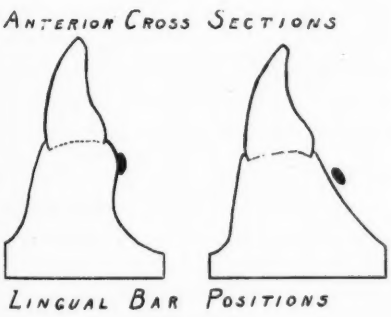

Fig. 28.

the case will be more or less of a failure. There is a tendency on the part of all clasps to incite decay. This condition is due to faulty design and improper care on the part of the patient. Reciprocal bearing is the essential feature of an attachment; and the success of the appliance depends on proper distribution of forces on tooth and soft tissue. The flexibility of the bar clasp gives it a distinct advantage over any of the cast clasps that we have previously used. Rarely, if ever, do we come in contact with a tooth so shaped that we cannot get proper anchorage using the bar clasp. We can positively establish reciprocal bearing, and come in contact with but little tooth structure, thus minimizing the likelihood of decay. I favor the classification which Dr. Roach employs in his partial denture work, i.e., careful survey, repairs, treatments and preparation, accurate impression technic, fundamental engineering principles involved in

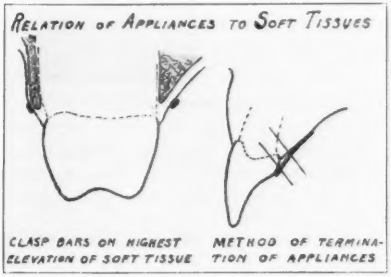
RELATION OF APPLIANCES TO SOFT TISSUES
CLASP BARS ON HIGHEST ELEVATION OF SOFT TISSUE
METHOD OF TERMINATION OF APPLIANCES

Fig. 29.

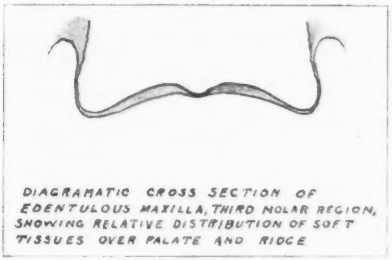
DIAGRAMATIC CROSS SECTION OF EDENTULOUS MAXILLA, THIRD MOLAR REGION, SHOWING RELATIVE DISTRIBUTION OF SOFT TISSUES OVER PALATE AND RIDGE

Fig. 30.

design and construction, proper installation and maintenance; a full appreciation of esthetics, physiologic function and the possibilities of pathologic sequence. The outline of procedure as given us by Dr. Roach is dependable and accurate for the construction of partial dentures in one piece castings. The bar clasp with all its variations and adaptations in combination with truss-bars is a proven success in my experience. In many cases, where teeth to which these attachments

have been made have been loose, there has been a gradual tightening, until they are as firm as any other tooth in the mouth. One should guard against having the flexible portion of the clasp rest upon the soft tissue. This can best be avoided by relieving the impression amply before running it up. These clasps and skeleton framework can be used equally well with either vulcanite or one of the condensites. Neither are they limited to posterior teeth: cuspids, upper and lower, are ideal for the bar clasp. Occasionally, conditions make it necessary to use lateral or central incisors for anchorage in the construction of partial dentures. Nearly any tooth can be successfully clasped with this bar clasp as a means of retention. Its advantages over the other designs of cast clasps are numerous. It is more flexible, covers little tooth structure and can be kept absolutely clean. Placing in position and removal by the patient are greatly simplified. It is less likely to lose its flexibility, which assures long life to the metal.

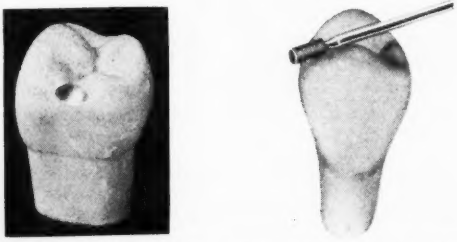

Fig. 31.—Left: Removing the marginal ridge. Right: Preparation for occlusal rest completed.

CLINICAL EXPERIMENTS ON THE EFFICIENCY OF ULTRAVIOLET LIGHT IN THE TREATMENT OF DENTAL DISEASE*

By THOMAS B. HARTZELL, M.D., D.M.D., Minneapolis, Minn.

ELECTRICITY has been of great value to the dental profession. We utilize it to drive our motors, to heat our furnaces, to fuse our porcelain, and some of us have attempted to use it, from time to time, to produce other effects. One of the early uses to which we attempted to put it was the anesthetization of dental pulps. I remember publishing an article on the use of the galvanic current to carry cocain through the tubules, into the pulp. It could be done, but it was not enough of a success to retain its place in common use. A few dentists continued ionization in the treatment of apical granulomas, placing the medicament to be carried to the infected area in the root canal and passing the electric current through the medicament into the diseased area at the root end. The late

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

M. L. Rhein was one of the most successful users of electrosterilization, having through long years of practice reported the successful use of this kind of medication. The method never became popular, and the dentist of today scarcely knows what ionization or catophoresis means in dentistry. Then came violet light. I recall sinking several hundred dollars in a Wapler mechanism for the application of violet light. We had small mouth electrodes to apply violet light to the gums, and we had large electrodes to apply violet light to the external surfaces. These were made 2 or 3 inches in diameter and handled on the surfaces as one would handle a warm flat iron. They were mildly valuable in the treatment of inflammatory and painful conditions, but worthless in the treatment of mouth infections, and after a few years of use, the devices for giving such treatment were quietly stowed away in attics. I remember attempting to sell my Wapler machine, for which I found no market. I then attempted to give it away, and nobody desired to utilize it, although it was a fine machine, in perfect condition, containing a quarter horse power motor. I finally rolled it out into the hall and allowed the ash man to take it away.

Now comes ultraviolet light, and we find certain manufacturers producing and advertising to the profession, machines costing all the way from $75 to $1,000 for the creation and application of ultraviolet light to dental problems. Ultraviolet light is said by some to be a sterilizing agent. This may be true, but I doubt that it is correct to speak of ultraviolet light as a dependable sterilizing agent, let us say, to prepare suture material, and anyone who expects to obtain sterility by its use will be disappointed. For example, its application to infected tooth surfaces and gums temporarily reduces the bacterial count in either smears or plated cultures, but, in a few hours at most, the bacterial mass on tooth surfaces is as great as before. In fact, there is no such thing as sterilizing animal or human body surfaces. I therefore believe that whatever benefit is received from our repeated nonblistering doses is due to the stimulation of the inflammatory action set up by it, for its application does not induce sterility. I attempted to kill bacteria with a light made by a machine manufactured by Curay for which I paid $35. I obtained this machine from Noyes Brothers and Cutler, of St. Paul, who had several of them in their stock which they were very glad to be rid of at almost any price. I utterly failed to kill cultures of streptococci or staphylococci with the Curay Lamp, and on applying its solid quartz electrode to the skin of the arm for five or ten minutes, I was unable to produce any reaction in the skin at all. In the mouth, repeated application to bleeding sockets failed to reduce pain, and many applications to gums invaded by pyorrhea organisms failed to check the disease in any way, so I quietly wrapped up that device in paper, and put it in storage, regarding its purchase and use as a closed chapter.

Still retaining an open mind and hoping for better things, I purchased a water-cooled quartz mercury lamp, a splendid looking instrument. I have for it several very fine quartz-electrodes, costing all the way from $20 to $40 each. I commenced a series of experiments on the tissues of the mouth in certain pyorrhea and abscess cases by applying the light for various periods of time to inflamed gums in an effort to evaluate the ultraviolet light as a remedial agent in the treatment of pyorrhea and dental abscess. It seemed to me that it would be fair to use the light only in a series of uncom-

plicated cases. This I did, in two different ways: one to apply in noninflammatory doses, the other to produce deep inflammations. I will speak of the noninflammatory dose method first. Noninflammatory doses, beginning with 15 to 18 seconds' application of a 55 volt current, were given twice a week. The resultant reactions were beneficial but not curative. The reason for this lies in the fact that the multiplication of the bacterial life in the mouth is infinitely fast. One would, to maintain a permanent reduction of mouth bacteria, need to use the light as regularly as his toothbrush, and as I see it, efficient tooth cleansing associated with gum stimulation by rubbing with either the ends of Johnson's No. 4 cotton rolls or toothbrushes, especially if a detoxifying agent is also employed, is less expensive and produces more lasting results because the destructive bacteria are consistently reduced and their toxins neutralized. Nature's own method of exercise for the gums does more to maintain health than many repeated light treatments.

I then used the methods that have been advocated by Dr. Sampson.[1] Dr. Sampson advocates deep, vigorous inflammatory reactions. In my experiments with these, I produced deep inflammations, some of which were sufficiently painful to cause the patients to decline further treatment by that method. In no case did the pyorrheal sores heal. In following this method, allow the burner to heat up till the volt-meter registers 55 volts, place the quartz electrodes against the gum tissues and press firmly enough to dehematize them. Sampson says, on page 375 of his book[1]: "The mere production of a blister on the gums is not enough, a violent reaction is necessary if the treatment is to succeed." Regarding pressure, he says, "The pressure should not be enough to break the quartz rod, but should be enough to visibly whiten the gum." He says, further, "If your lamp will blister in 40 seconds then, give 70 to 80 seconds' contact under pressure." Burns thus produced are painful and have not, for me, produced lasting cures. Regarding apical abscess, I can report that, in no single instance, in the one year's work that I put in on this experiment, have I succeeded in sterilizing a single granuloma. Nor do any of these lesions show complete regeneration of bone. Some of them seem to show a partial reduction in the size of the dark shadow area, but the root-canal dressing continues to produce growth. I have tried carefully to exclude external contamination of canal dressings. Every bit of cotton placed in the canals was first passed into a melted metal, the temperature of the metal being 600 degrees. The tooth was bathed in iodin tincture and washed with pure alcohol, and the dressings sealed in with "wondrpak." Before removal, the teeth were subjected to the same treatment, to wit, given an iodin bath, the "wondrpak" plug removed, iodin reapplied, the dressing withdrawn and, with flamed scissors, the tip of the cotton cut, so it fell into a tube of sterile broth. In one single instance, the dressing produced no growth, but, unfortunately, a subsequent dressing did.

My conclusion is, therefore, that we cannot cure or sterilize apical granulomas by the use of ultraviolet light by any now known method of its application, because sterile cotton placed in the granulomatous root tips always produces growth. Not one of the many abscesses to which I applied the light, as suggested by Sampson, healed; nor did one of them

1. Sampson, C. M.: Physiotherapy Technic, St. Louis: The C. V. Mosby Company, 1923: p. 369.

become sterile. I used, always, at least ten applications of a 55-volt current through a water-cooled quartz mercury lamp to produce the light, which was in turn made to shine on the tissues through a water-filled quartz electrode, the latter being so placed as to deliver the light over the abscessed area, both lingually and labially. In the event that the root of the tooth is straight, some operators apply the light so that it shines through the canal into the abscessed area. I cannot see that this is any more effective than its application as outlined above. It is to be hoped that these costly modalities may sometimes become as valuable as they are claimed to be.

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C. N. JOHNSON, Editor

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Editorials

DONATIONS FOR BUILDINGS OR FOR MEN—WHICH?

The splendid philanthropies of our wealthy citizens in the way of endowments to universities and other institutions in this country whereby large sums have been donated for educational purposes have excited the admiration of the entire world; and it is a tribute to the sagacity and the prescient vision of our moneyed men that philanthropy has taken this particular turn. Anything that contributes to the better education of our youth is commendable because education is a real asset to an individual or a nation.

When these large endowments are placed at the disposal of our university authorities, it becomes very important that they be administered with wisdom and that the funds be dispensed in a way that will result in the greatest possible benefit to society. The object of all education should be the betterment of our citizens through the medium of a more efficient young manhood and womanhood. Without a continual influx of new, virile and well-balanced personnel in the community councils, no commonwealth can advance to its des-

tined status, and thus the concentration of effort in our educational institutions should be on the problem of training our young men and women for the real tasks of later life. And how shall this best be done?

This query at once leads us to an examination of the dominant influences in education. What are the most significant factors in college life? One would think from the distribution of these large endowments that fine buildings constituted the alpha and omega of our educational scheme. Huge sums are devoted to the erection of imposing edifices, which are intended to claim the admiration of the world, and which do claim this admiration. All of this would be most commendable, if there were not another side to the picture. Good buildings are necessary—even fine buildings are desirable—but there is another thing that is still more necessary and more desirable, and that is the highest possible type of instructors and professors. The soul of an educational institution is not made up of material things such as buildings. It is made up of the human element which dominates the teaching policies and directs the energies of the youth who attend these institutions. The diversion of so much money to the erection of fine structures at the expense of adequate compensation to the teaching staff at once raises the question as to which is more important, brick and mortar or brains and human intelligence; because the best brains cannot be bought today for the meager salaries that are paid to college professors. Some men and women of ability continue teaching because of their inherent love of the work and because their environment has led them in that direction; but few individuals of real ambition or initiative—the very type that are most needed to direct the destinies of youth—can be held in university positions by the inducements offered today.

What is it that a young man or woman remembers longest after leaving college? Is it marble halls or ornate dormitories, or certain wings to certain buildings? Rather, it is the human touch, the influence of certain professors, the individuality of the various teachers, the things that are said to them by their instructors. The factor in education that really counts is the example set in the class room and

on the campus; the daily and hourly contact of the men and women to whose care the students are committed. It is the influence of human interest and human sympathy instead of the influence of art as expressed in beautiful buildings. Youth is moldable at the period of attending college, and it is important that it be more impressed with character building than with architecture.

To teach a boy or girl the one lesson of individual responsibility means more than to surround this boy or girl with all the beautiful buildings in the world; and the best lessons of life are imparted only when the instructors are given some self-respect by adequate compensation. The teaching profession is one of the most exalted of all callings, but it can never blossom into full fruitage on an impoverished support, and the sooner our philanthropists and university authorities awaken to this fact, the better.

It is the spirit that is instilled in the youth of the land that constitutes the better part of education, and the proper spirit cannot be transmitted to others unless it is a very part of the one who seeks to transmit it.

Let us erect fine buildings if we may, but, above all things, let us encourage human enthusiasm and devotion in the teaching profession by a sufficiently liberal compensation to enable our university teachers to hold their heads up among men. As it has been in the past and as it now is, our college teachers have found it necessary to supplement their meager salaries by outside service whenever they get the opportunity, and this makes their calling almost a beggarly occupation. This is not as it should be and the time has come for a radical reform. After this, let endowments specify that adequate compensation shall be given the teaching staff first, and that the erection of fine buildings shall be secondary.

THE COMMITTEE ON THE COST OF MEDICAL CARE

The work of the Committee on the Cost of Medical Care is gradually rounding into shape and it promises to touch the welfare of humanity in one of its most vital points. It is doing something

more than merely estimating the cost of medical care. It is looking into all kinds of agencies connected with disability resulting from illness, and studying with some care the economic factors involved. It has issued a brief review on "the first two years' work," in which the statement is made that "The Committee on the Cost of Medical Care has been engaged for a year and a half in an actual study of the economic aspects of the care and prevention of illness. Its study is primarily a search for facts. It is in no sense committed to any theories or policies regarding the future organization of medicine. It does not know how the present obvious weaknesses in the field of curative or preventive medicine are to be remedied, and it has no intention of arriving at any conclusions until the facts have been secured. When the essential data are available, the committee hopes to be able to offer a series of recommendations designed to improve the unsatisfactory situation existing at present."

Certain studies are already completed, such as, "Extent of Illness and of Physical and Mental Defects Prevailing in the United States—a Compilation of Existing Material"; "A Survey of Statistical Data on Medical Facilities in the United States—a Compilation of Existing Material"; "Medical Care for Thirty-Four Thousand Workers and Their Families—a Survey of the Endicott Johnson Workers Medical Service"; "Hospital Service for Patients of Moderate Means."

It will thus be seen how fundamentally the committee is going into the problem, and it should have the support of every progressive thinker. The present unsatisfactory situation in the management of illness or disability cannot longer be tolerated. It is unsatisfactory alike to the members of the professions and to the laity who come under their care, and it is a very encouraging trend of the times to note the earnestness with which this committee is approaching the problem of trying to work out a solution that shall be satisfactory to all concerned.

At the recent meeting of the American Dental Association in Washington, the Association voted to cooperate with the Committee on the Cost of Medical Care and appointed a committee for this

purpose. This committee consists of Herbert E. Phillips, Harold J. Leonard, C. E. Rudolph, R. E. Denny, and Guy S. Millberry. Thus, our Association is definitely committed to active participation in this movement, and we bespeak the interest of every one of our members in an effort to aid the committee toward a solution of this most pressing problem. What concerns medicine in its relation to the public needs equally concerns dentistry, and we shall never meet the situation by following the tactics of the ostrich and hiding our head in the sand whenever this subject is broached.

More and more, the dental profession is becoming an integral part, not only of health service but also of our entire social fabric, and we must recognize the fact that our duties relate to the community as well as to the individual. One of the first activities of the A. D. A. committee will be to make a survey among dentists to gain light on certain of the economic problems which confront the profession, and, to this end, it is the purpose to send out a questionnaire to our members. Manifestly, with the limited budget of the committee, this questionnaire cannot go to every member of the Association, but a typical cross-section of the profession will be taken and, on this basis, a very intelligent idea can be gained of the conditions in actual existence today.

It is with this questionnaire that we wish at this time to deal. The questions have not yet been definitely formulated, but they not only will be of a nature to throw light on the situation but also can be answered freely without embarrassment to any one. There is always a tendency on the part of professional men to hesitate to give for public use information regarding their private affairs, and this is only natural, but it is not the intention of the committee to seek specific information of a private nature, and, as we understand it, all questionnaires are to be answered incognito. The result of this questionnaire will be of great benefit not only to the committee but to the entire dental profession as well, and it will convey information never before tabulated.

The reason for bringing this matter up at this time is to urge every one who receives a list of questions to answer them frankly and promptly, to the end that this survey may contribute to the

movement the greatest amount of authentic information. We have the conviction that dentists everywhere should lend their aid to the work of this committee. This is the first systematic effort to gain an intelligent idea of the real facts concerning our economic relations with the public, and every professional man will profit in the end by such knowledge. Till now, there has been no opportunity for a perfect understanding between the people and the professions, and, without an understanding, there is always certain to be more or less friction and resentment. Let us do away with this by a whole-hearted cooperation with the efforts of the committee, to the end that our contact with the people shall be more equitable and satisfactory.

RESPONSE FROM THE CHRISTMAS SEALS

So far this year, the response from the Christmas seals is very gratifying, and our members who are so generously contributing are entitled to the thanks of the beneficiaries, the Relief Commission and every one else who has this movement at heart. Some of the letters that accompany the contributions are most generous and heartening. Here is an extract from one: "It is with pleasure that I enclose my check for $1.00 for the A. D. A. Relief Fund. I have no hope of regaining this contribution, but I am glad to have the opportunity of assisting in the relief of some fellow practitioner who probably thought he would never need relief." Another comment is as follows: "The men in any community could never accomplish, even with self-sacrifice in abundance, what our organization can accomplish, with only a 'widow's mite' from each member." This is the keynote to the entire movement. By cooperation from each member, the good that can be done through the medium of the relief fund is beyond estimate. This is amply borne out by the experiences of the Relief Commission. To them come more intimately than to any one else those confidences of the ones who are being relieved, with all of the pathos and tragedy that go with the needy and infirm. Every member who sends in a contribution for the Christmas seals must have a supreme sense of satisfaction when he contemplates the

good that is being done by his beneficence, and as the significance of the work becomes better known, the response will be more widespread than it is.

One thing should be borne in mind, and that is that every dollar of income goes directly for relief except the necessary expenses of printing and mailing the seals each year. It may be interesting for our members to examine an audited statement in connection with this relief fund, and we take pleasure in appending it herewith.

STATEMENT SHOWING RELIEF FUND EARNINGS AND DEDUCTIONS

	Year Ended June 30, 1928	Year Ended June 30, 1929
Earnings on relief fund investments	$10,300.10	$10,111.44
Christmas seal expense (printing, mailing, etc.)	$ 1,756.15	$ 2,044.17
Contributions to needy dentists	3,923.68	6,164.96
Total deductions	$ 5,679.83	$ 8,209.13
Remainder	$ 4,620.27	$ 1,902.31

The foregoing figures readily show how the increasing demands for relief are resulting in a smaller margin and, should this increase continue, as is very probable, the income will not be sufficient to meet these demands.

RECEIPTS FROM CHRISTMAS SEALS

	Year Ended June 30, 1928	Year Ended June 30, 1929
Alabama	$ 88.00	$ 84.00
Arizona	18.00	33.00
Arkansas	28.00	28.00
Army	9.00	14.00
California	905.00	962.50
Colorado	224.50	161.10
Connecticut	286.00	303.00
Delaware	18.00	20.00
District of Columbia	166.00	214.00
Florida	85.00	87.00
Foreign	11.00	136.80
Georgia	117.00	130.00
Hawaiian Islands	16.00	27.50
Idaho	45.50	30.50
Illinois	1,463.25	1,563.50

	Year Ended June 30, 1928	Year Ended June 30, 1929
Indiana	371.00	349.07
Iowa	289.00	410.00
Kansas	150.60	195.50
Kentucky	146.00	141.50
Louisiana	74.10	93.00
Maine	70.00	61.00
Maryland	136.00	156.00
Massachusetts	599.00	657.00
Michigan	501.00	580.50
Minnesota	454.00	613.00
Mississippi	53.10	51.00
Missouri	366.75	371.10
Montana	53.50	68.00
Nebraska	128.00	135.00
Nevada	13.00	7.00
New Hampshire	26.50	32.50
New Jersey	536.00	556.00
New Mexico	37.00	34.50
*New York	3,444.60	4,293.50
North Carolina	90.50	97.00
North Dakota	74.00	84.00
Navy	6.00	6.00
Ohio	641.50	766.00
Oklahoma	82.00	101.00
Oregon	130.60	126.00
Pennsylvania	1,182.00	1,174.50
Porto Rico	.....	8.00
Rhode Island	65.00	66.00
South Carolina	32.00	29.00
South Dakota	48.00	54.00
Tennessee	128.00	123.00
Texas	273.50	351.65
Utah	58.00	89.50
Vermont	26.00	29.00
Virginia	163.00	148.00
Washington	226.20	212.50
West Virginia	105.00	117.00
Wisconsin	431.00	464.10
Wyoming	33.00	22.00
TOTAL	$14,724.70	$16,668.82

*Includes contributions from dental goods manufacturers, dealers and other agencies outside the Association.

In one particular, the foregoing statement is most encouraging; in another, it makes us pause. The receipts from the seals are larger each year, but not sufficiently large to increase the income to keep pace with the increasing demands of our needy. In order to accomplish this, we must work as we have never worked before, and our membership must awaken to the necessity of building up the principal fund till the interest will adequately care for our worthy needy members. It will never do to falter in the work when the legitimate demands of our needy fellow members are increasing at the present rate. It would place the members of the Relief Commission in a most distressing and embarrassing situation to be obliged to refuse relief to any deserving applicant through lack of funds, and we hope that such a thing may never happen. Certain states have been peculiarly fortunate in the fact that they have had no cases in their midst that were in need of relief, and this has of necessity contributed to an uneven distribution of the funds in different states. This cannot be helped, but there is one feature of this unevenness that should be noted: On checking up in some states, it has been found that the amount distributed for relief has exceeded the total amount contributed by those states in payment for the seals. Manifestly, this cannot be claimed as a balance on the right side of the ledger, and we are sure that no state cares to be found in this category.

The more widely the intimate working of the relief fund becomes known, the more generous will be the response; which in substance means that the members of our profession may be depended on to do the just and generous thing wherever they see the need and understand the situation. If you have not remitted for the seals this year, it is not too late to do so now.

CREDO!

Ever since the first report of the A. D. A. Bureau of Chemistry on the results of its investigations of dental proprietary remedies and nostrums was published, there has been a constant stream of letters congratulating the Bureau and THE JOURNAL for their efforts to aid

the profession to rationalize its materia medica and to protect the public against the maneuvers of none too scrupulous nostrum dealers. The response of the profession has been spontaneous and was not brought about through forceful speakers or silver-voiced spokesman. Its work and results act as the Bureau's spokesman, and, happy to relate, the profession is lending a ready and attentive ear. Proprietary dealers must take this long dormant but now active mood in mind; for no longer are the progressive members of the profession willing to be "bought for thirty pieces of silver," as it were. One member of the profession feels thus about the situation. We are happy to reprint his letter in full.

Under the date of November 11, the enclosed communication was received from the .....

I believe it to be the duty of the dental profession and the dentists as a unit, to lend every assistance possible to the A. D. A. Bureau of Chemistry in its courageous and righteous fight against the advertising methods used by unscrupulous trade organizations in their endeavor to foist upon the public material of questionable character.

I believe that the dental profession, to fulfill its moral obligations to humanity, is bound to protect the public against the assaults of fakers, whether these assaults are directed against the health or the purse.

I believe that this fight should not be a private one between the A. D. A. Bureau of Chemistry and the Slick Ones.

I believe that no dentist should have to ask the question that the Irishman coming on a big brawl in the street asked a bystander: "Is this a private fight or kin anybody get in?" Everybody "kin" get in this one and should. Every dental society must take this fight up, and the officers as leaders make it plain to the members that they ought not be bought by the "thirty pieces of silver" offered in the shape of samples.

The concerns who have fallen under the ban of the A. D. A. Bureau of Chemistry and persist in antagonizing the Bureau in other than a scientific honest manner should feel the consequences, and the dentists receiving literature such as the ..... specimen should direct a letter containing in no uncertain terms the information that we stand solidly behind our chemical Bureau and want none of their samples and further that our patients will be made cognizant with the fallacy of their claims.

If there is any further information relative to ..... please acquaint me of it, for I am going to open battle here through the medium of our dental societies and dental literature.

I congratulate you upon the progress of your work, and please allow an interested member of the dental profession to wish you unlimited success.

In spite of the progress made in the brief time the Bureau has been in existence, the fight against the evils of proprietarism and

quackery has just begun. The dental profession, always cognizant of its duty to the public, will not be found wanting in this battle against that monster, the proprietary evil.

LA FAYETTE LYMAN BARBER, D.D.S., F.A.C.D.
(1859-1929)

By HOMER C. BROWN, D.D.S., F.A.C.D., Columbus, Ohio

La Fayette L. Barber was born in Toledo, Ohio, Aug. 5, 1859. He died suddenly, Nov. 23, 1929.

Dr. Barber received his dental degree from the University of Michigan in 1885. He had served as president of the Toledo Dental Society, the Northern Ohio Dental Association, the Ohio State Dental Society and the American Dental Association. He served six years as a member of the Ohio State Board of Dental Examiners, and was a member of the Committee on Dental Legislation of the American Dental Association for ten years and for years a member of the Legislative Committee of the Ohio State Dental Society. He was elected a member of the Research Commission shortly after its organization, serving as a member of its executive board for the past nine years and also as a member of its special Bureau of Standards Committee. He was also a member of the Committee on Standardization of Dental Proprietary Products; of the Callahan Commission of Award, and of the Preparedness League of American Dentists. He was a Fellow of the American College of Dentists.

He was appointed by President Wilson as a delegate to the International Dental Congress held in London in 1914. During the World War, he served as a member of one of the important committees of the National Council of Defense, which was organized during his term of office as President of the American Dental Association. He was appointed by Governor Harmon as a delegate to the International Congress on Hygiene and Demography held at Washington in 1912. In addition to the foregoing, he had served on various other committees of his local, state and national organizations. He had attended thirty-six consecutive meetings of the national organization.

Dr. Barber had not been in the best of health for some time, but he continued in practice up to the time of his death, which occurred while he was attending a football game.

He is survived by a sister, Mrs. Clara Smith, with whom he made his home, and two brothers.

LA FAYETTE LYMAN BARBER, D.D.S., F.A.C.D.
(1859-1929)

EDWIN TYLER DARBY, D.D.S., M.D., LL.D

1845-1929

Edwin T. Darby was born at Binghampton, N. Y., Aug. 21, 1845, and died at Lansdowne, Pa., Dec. 11, 1929. He was emeritus professor of operative dentistry in the Dental Department of the University of Pennsylvania at the time of his death. He was educated at Cortland Academy, Homer, N. Y., and began the study of dentistry in 1862 with Dr. R. Walker of Owego, N. Y. At the age of 17, he began

practice for himself at Marion, N. Y. In 1864, he was graduated with the D.D.S. degree from the Pennsylvania College of Dental Surgery. In 1879, he took his M.D. degree at the University of Pennsylvania, and in 1915, he was given the honorary degree of LL.D. by the same institution. In 1876, he became professor of operative dentistry in the Pennsylvania College of Dental Surgery, and from 1878 to 1920, he was professor of operative dentistry, histology and pathology at the University of Pennsylvania.

He was president of the Pennsylvania State Dental Society in 1875, a member of the Pennsylvania State Board of Dental Examiners, 1875-1883, and president of the American Dental Association in 1883. In 1906, he was awarded the Jarvie Gold Medal by the New York State Dental Society. He was the first president of the Philadelphia Dental Society at the merger of five constituent societies. He was an honorary member of the New York State Dental Society, the Illinois State Dental Society and the Northeastern Dental Society of Philadelphia. He was supreme grand master of Delta Sigma Delta in 1919.

To thus give in categorical order the main achievements of Dr. Darby's professional career is a simple matter, but this falls far short of telling the real story of his life. Nor can this story ever be adequately told, for the reason that he touched his fellow men at so many different points that the diversity of his human contacts and human interests baffles any attempt to record them. Of all that splendid band of men who represented the highest and best in dental thought in the latter part of the last century and fore part of this, Dr. Darby stands out as one of the most distinguished. Wherever progressive dentistry was mentioned, the name of Dr. Darby was coupled therewith. And it was not because of his understanding qualities as leader—though Dr. Darby could lead when the occasion demanded it—but because of those inherent instincts of honor and gentlemanly demeanor which marked him at every stage of his varied activities. If ever there was a typical example of a true professional gentleman Dr. Darby was the superlative of that type. He constantly maintained the honor and dignity of his calling, and he did it without the slightest tendency toward pedantry or affectation.

Above everything else, he was genuine. There never entered his mind the slightest notion of evasion or subterfuge of any sort. Without being obstrusive in the slightest degree, he stood foursquare to the world in a modest but fearless way, and no one was ever left to doubt where Dr. Darby stood on any of the leading questions of the day.

If space permitted, many instances might be given of his delightful companionship and his rare personality; but better far than any feeble written word is the indelible record of his daily contact with his fellow men for so many years, filled with the sweet savor of his perennial spirit, and the hallowed influence of his blameless, loving life. We bow our head in grief and reverence at the hour of his passing, but we raise it again in blessed memory of the beneficence bestowed on us by the privilege of having known him so well, and of having enjoyed so many friendly impulses of his loyal heart.

C. N. J.

EDWIN TYLER DARBY, D.D.S., M.D., LL.D.
(1845-1929)

BUREAU OF DENTAL HEALTH EDUCATION

HOW CHICAGO ARRIVED AT ITS PRESENT STATUS IN PUBLIC HEALTH DENTISTRY*

By LON W. MORREY, D D.S., Chicago, Ill.

TO describe or even attempt to describe how Chicago arrived at its present status in public health dentistry is worthy of the pen of a Hugo. It is a saga dealing with the ideals, dreams and convictions born in the minds of a handful of men twenty years ago, ideals the seed of which was laboriously, painfully and slowly sown, first in the minds of their fellow practitioners and later in the minds of others, ideals which resisted ridicule, disbelief, apathy and, in many cases, downright hostility.

The history of Chicago's fight for public health dentistry probably has its parallel in similar fights in every city in the country. Therefore, in reciting our history, we may be telling you a story with which you are already familiar, except that our story has different characters, different dialogue and a little different scenery.

In looking over the records, we find that it was twenty-one years ago, in 1908, that a few dentists in the Englewood branch of the Chicago Dental Society first established a children's dental dispensary in one of Chicago's schools.

The establishment of this dispensary was a very humble beginning indeed. The equipment was donated by various dental supply houses. Supplies were purchased with money donated by the dentists and often by the friends and patients of the dentists. A small group of members of the society donated one-half day a week of their time to care for the dental needs of the poor children.

The success of this dental dispensary soon led to the establishment of two more and the installation of a second dental equipment in the original school. By 1911, Chicago, with a population of 2,200,000, boasted of four school dental dispensaries. The three years between 1908 and 1911 were long, lean years. While at first every one contributed more or less generously toward the supply fund, three years of voluntary contributing lessened the ardor considerably, so that by 1911, filling material, instruments and other equipment were at a premium. Three years of voluntary service also had its effect on the enthusiasm of those men who were called on to donate their services. The leaders of the profession became professional beggars or solicitors in begging funds from their patients to finance the procedure. Quite obviously, no undertaking founded and financed on such an unstable foundation could exist for long.

*Read before the Section on Mouth Hygiene and Preventive Medicine at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

During 1910 and 1911, a dental survey was made in the schools by members of the Chicago Dental Society. This survey confirmed the opinions of the members of the society that dental care was necessary for the children and that this work should be placed under the supervision of a man who could conduct it efficiently. Frederick F. Molt was chosen for this position, and during his tenure of office, he put into effect, on a small scale, a very efficient system. If this system had been continued and enlarged, as he had planned, the teeth of Chicago school children at the present time would be at least 75 per cent better.

I once mentioned the fact to C. N. Johnson that practically the same ideas regarding the procedure of a mouth hygiene program prevailed fifteen years ago as are prevalent today. Dr. Johnson replied: "Yes, everything is practically the same, as is also the method of education and operation. Conditions are the same, the attitude of the dentists is the same. The only difference is that public opinion has changed. In those days, we had to fight public opinion; today, public opinion is with us."

So for twenty years the dental profession of Chicago has been molding public opinion. Twenty years is a long time; yet, all lasting reformations take long in the building. As A. E. Morgan, president of Antioch College, says, "Taffy candy or cold tar, by moderate pressure for a long period, can be molded or bent to any shape. Under sudden pressure, it resists change and if the pressure is great enough, it breaks like glass. Wisdom will grant time for adjustment and will not force too rapid changes in conviction and outlook. The change, which is ruinous if it comes too quickly, in its own time is as normal as growth."

So it would seem that during the past twenty years, while the more impatient members of the profession were lamenting the fact that Chicago was lacking in civic pride in not developing its dental program faster, the most important work, that of molding public opinion, was being accomplished.

In 1912, at the solicitation of the Chicago Dental Society, Julius Rosenwald, the philanthropist, financed six dental dispensaries and paid the salaries of the operators for three years, so that, between 1912 and 1915, Chicago schools boasted of ten part-time children's dispensaries.

In 1915, these dispensaries were turned over to the public health department of the city for operation. Immediately the program began to retrogress. It was quite evident that public opinion had not been molded sufficiently. Seven years of dental activity in the public schools had sufficiently convinced only the more public-spirited leaders of the dental profession of its desirability, but they, in turn, had not sufficiently convinced the public of its worth. I do not believe that our profession should be criticized for this fact. As Dr. Morgan says, "Molding public opinion is a slow, tedious process." Seven years had barely molded the opinion of some of the dentists, to say nothing of the public. Even today, after twenty-one years of intensive molding, many of our profession are unconvinced that public health dentistry is desirable.

The failure of the program in 1915 not only proved that public opinion had not been sufficiently molded, but it also proved that no program, no matter how worthy and no matter how ardently sponsored by a few men or by one organization, can be successful unless the public is fully cognizant of its worth and desirability. Between 1915 and 1927, the program rose and fell according to the

attitude and enthusiasm of the politicians, the board of education, the department of health and the members of the dental society.

In 1919, the municipal tuberculosis sanitarium, an institution founded for the prevention of tuberculosis, opened nine part-time dental dispensaries. During the past ten years, these nine dispensaries have cared for thousands of children's teeth.

In 1923, the Chicago Dental Society was able to interest the Cook County Commissioners to such an extent that an eight-chair children's dental dispensary was installed in the Cook County Hospital. Both the Chicago Municipal Tuberculosis Sanitarium and the Cook County Hospital are confining their efforts to operative work only, little educational work being attempted.

In 1923, a large building on the near west side was designed and partly built by the city for a central dental clinic. The money used for this purpose was derived from the proceeds of the Pageant of Progress, a civic industrial exhibit. A change in civic administration halted the procedure, and it now stands a desolate and uncompleted monument to what might have been.

The year 1927 brought to Chicago a health commissioner who was primarily a surgeon by profession, a man whose past experience had convinced him that dental defects were responsible for many physical ills and who was wise enough and far-sighted enough to realize that preventing dental disease was a big step toward preventing illness.

May it be said to his credit and to the credit of the dental profession of Chicago that the first big audience which Arnold H. Kegel addressed after taking office was the Chicago Dental Society, in 1928. At that time, Dr. Kegel pledged himself and his department to do all in their power to develop a dental program sufficient for the needs of Chicago's children.

I do not believe that Commissioner Kegel knew at that time that public opinion regarding preventive dentistry had been molded to the proper consistency. Neither do I believe that the leaders of the Chicago Dental Society were aware of this fact. I do know that the leaders of our profession immediately realized that at last they had a commissioner of health who was kindly disposed toward their problems, and I do know that they immediately took advantage of the fact by appointing, at his suggestion, an advisory committee to work with him in developing a comprehensive dental health program for Chicago children.

The dental advisory committee is composed of sixteen men. Great care was used in selecting and appointing a large and well-rounded committee, so that all branches of the Chicago Dental Society would be represented and kept interested. The object of this committee was, first, to enlist the active interest of all the members of the society; secondly, to develop a program sufficient for the school needs of Chicago, and, thirdly, to interest outside agencies in the program to such an extent that it could be put into effect.

The first move which this committee made was to ask for a survey of the school children's teeth. In response to an appeal from the commissioner of health, more than 625 members of the Chicago Dental Society examined the mouths of approximately 66,000 children in the first, third and fifth grades of school during the last week of April, 1928. This examination or survey served two purposes. First, it aroused the interest of the dental society as a whole, because the members of the society who participated

in the survey saw dental conditions which they never realized existed, and, secondly, it gave us additional facts and figures regarding the dental condition of our own children which we could use as a sales argument and upon which we could build our program. The tabulation of the figures resulting from this survey disclosed many interesting conditions. Ninety-six per cent of our children had decayed teeth, with an average of four and one-half cavities per child. Our 500,000 school children, it is estimated, harbored between 2,000,000 and 2,500,000 dental defects.

The making of this survey called for a tremendous amount of energy and work on the part of the committee. Several mass meetings were held. Each of the five branch societies lying within the city limits of Chicago held separate meetings. Assignment of dentists had to be made; supplies, record cards, etc., had to be sent to the schools and picked up after the survey was completed; nurses from the department of health were assigned to assist in this work, and, finally, the figures were tabulated. And, as I say, from this tabulation a feasible plan had to be developed and later put into effect. Our work was cut out for us, but it was far from being finished.

The Chicago mouth hygiene plan developed by Commissioner Kegel and his dental advisory committee, from the findings of this survey, is two-thirds educational and one-third operative in character.

As originally planned, we were to place one dental dispensary in each of the fifteen school districts to care for the dental needs of children unable to afford private care. The plan also called for two examining dentists and two dental hygienists to work in each of the fifteen school districts, to examine the mouths of and educate the children.

Such a program, including the purchasing of equipment and supplies, would cost the city about $236,000 a year.

Asking the city council for $236,000 last year, when the city was in the midst of an economy program, would have been suicidal if public opinion had not been with us. How the commissioner of health and his dental advisory committee were able to bring sufficient pressure to bear on the members of the governing body to appropriate funds for this purpose is to me the most interesting chapter in the history of the movement.

At this point, permit me to digress for a moment to sketch briefly the history of another organization which played a very important rôle in the establishment of our program.

Four years ago, in 1925, an idea was conceived in the minds of three people in the State of Illinois, which later was nourished, developed and put into effect, with the nebulous thought that some day it might mean some practical good for the child life of our state. In the fall of 1928, this idea, which had taken on concrete form, suddenly loomed on the horizon of the Chicago Dental Society and became one of the big factors, if not the biggest factor, in making our program possible.

During an informal discussion between a member of the Illinois State Dental Society, a member of the Illinois State Medical Society and a member of the state health department, the idea was promulgated to form a committee, composed of a representative of the Illinois State Dental Society, of the Illinois State Medical Society, of the Illinois Congress of Parent-Teachers, of the Illinois Federation of Women's Clubs, and of the Illinois State Nursing Association, in or-

der that the public health activities of these several organizations could be correlated and united in their efforts throughout the state. Each month, this committee met. Each month, new obstacles were overcome, until, by 1928, there existed an almost perfect understanding of each other's problems, desires and ambitions.

In September, 1928, after the plans for Chicago's mouth hygiene program had been definitely agreed on, Herbert Phillips, representative of the state dental society and chairman of the child hygiene committee, which was called the advisory committee to the child hygiene division of the Illinois State Department of Public Health, advised his fellow committee members of the plan and asked for their assistance and support. Immediately, each member of the committee notified its parent body of the program, and each of the organizations represented, with the exception of the state medical society, voted to endorse the mouth hygiene program proposed by Commissioner Kegel and the Chicago Dental Society.

The action of the Child Hygiene Advisory Committee in endorsing the program made it possible for the dental society to secure the active support of 38,000 members of the Illinois Congress of Parent-Teachers and 33,000 members of the Illinois Federation of Women's Clubs, besides the 2,500 members of the Chicago Dental Society.

The tacit support of these organizations was not enough, however. It was necessary that the city's governing body be acquainted with the fact that these organizations wanted a mouth hygiene program in our Chicago schools.

This was accomplished in the following manner:

The City of Chicago has fifty wards and each ward has one alderman. The Chicago Dental Society was divided into fifty districts and from two to five dentists in each ward or district were assigned to call on their alderman. The parent-teacher association was likewise districted, and five women were assigned to call on their alderman. The same procedure was carried out by the women's clubs. A committee of five club women was assigned to each ward. Many of the individual dentists requested their patients to call on their aldermen. The officers of the branch dental societies, the officers of the 200 or more parent-teacher associations and the women's clubs wrote letters and called on their representatives in the council. For two months last year, November and December, a campaign of letters, postal cards, telephone calls, telegrams and personal interviews was carried on to such good effect that every one of our fifty councilmen received from 200 to 300 requests to vote for a dental hygiene appropriation. During the final meetings of the city council finance committee, when the budget for 1929 was being prepared, a committee composed of representatives of the Chicago Dental Society, the Congress of Parent-Teachers, the Federation of Women's Clubs, the United Charities and the Chicago Council of Social Agencies called on them and presented their plea for a dental health program.

I said in the beginning that it would require the pen of a Hugo to describe the history of Chicago's mouth hygiene movement: it certainly would require the pen of a Hugo to describe the work, energy and anxiety of the committee during those few weeks when the city finance committee was trying to cut its budget to fit an economy campaign and at the same time appropriate funds for a dental hygiene bureau.

We did not get our $236,000, but we did get $110,000, and may it be said to the everlasting credit of Commissioner Kegel and his dental advisory committee that at a time when the city's budget was cut $5,000,000, and when the appropriation of every other department in the city administration was cut, the health department received an increased appropriation of $110,000.

Our present program is being developed along the lines originally proposed, except that the personnel of our staff is not so large as we need. We work only in the kindergarten and first four grades and we are bending every effort to have the children's dental work done by the private practitioner.

We employ seventeen dentists and seventeen dental hygienists who do the examination and educational work, and twelve dentists who do operative work for children whose parents, for financial reasons, could not otherwise have the work done. All of our staff work full time.

Our program is not perfected. Each day sees need for changes, and these changes are being made as rapidly as is consistent with careful management.

Our greatest need at the present time is good educational material to be used in connection with our school work, material that is suitable for teachers, dentists and the children. A great opportunity awaits someone with the vision and ability to develop such material, since our department is not alone in this need.

Health departments throughout the country are each year taking a more active interest in preventive dentistry. I believe that at least 50 per cent of preventive dentistry, as we now know it, must be undertaken by either boards of education or public health agencies. However, this work should be undertaken only with the active cooperation of the local dental society. This is said because of the vast amount of work that is being done by voluntary organizations in promoting health instruction, influencing standards and practices, supplying funds for research and demonstration, and assisting in the enactment of hygiene legislation, and also, because of the fact that this work is under the control and supervision of lay boards associated very loosely or not at all with medicine or dentistry.

Unfortunately, the vast majority of the dental profession in the past have been trying to fight dental decay from the point of view of the private practitioner. We have not taken the interest in public health community problems that we should. The time has now come when dentists with their background of general education and specific learning, acquired over years of study, must take the same interest and must display the same intelligence in community health matters as their fellow townspeople.

At the present time, there is a woful lack of understanding on the part of many practitioners regarding public health dentistry. As this branch of public health service is advancing rapidly, I believe there is a great opportunity for our dental colleges either to prepare the dental student for this type of work when he graduates or, at least, to acquaint him with the necessity of such activities. We must bear in mind, that public health preventive dentistry should be chiefly educational in character. I believe it is the duty of public health agencies to educate the public to the necessity of having dental defects corrected. It is the duty of the dentists to educate, as well as to make the corrections.

CONCLUSION

Allow me to repeat that the history of twenty-one years of effort on the part of the Chicago Dental Society, culminating as it did this year in what we all hope to be a permanent dental program for Chicago's school children, certainly proves that no program, no matter how worthy, can be a success unless public opinion is in favor of it. The most successful method of creating favorable public opinion is to secure and keep the active cooperation of the largest, most influential and powerful organizations in the community; for, as Kipling says,

> It's not the guns or armament
> Or the money they can pay,
> It's the close cooperation
> That makes them win the day.
> It is not the individual
> Or the army as a whole,
> But the everlastin' team work
> Of every bloomin' soul.

NATIONAL ORAL HYGIENE THROUGH A VOLUNTARY LAY ORGANIZATION*

By HARRY S. THOMSON,† D.M.D., Toronto, Canada

JAMES H. FURAY, president of the United Press, in an address to the First District Dental Society of the State of New York, likened dental disease to a criminal. He said: "There is a villain at large. He may be merely a poisoner—he may be a murderer, but he is a villain and an enemy to society. He is that something which causes decay of the teeth, infections of the mouth and the body, and above all he is that something which works twenty-four hours a day to break down the general health of mankind, and leaves his mark on the lives of his victim."

A prominent executive of one of the largest life insurance companies in the United States says: "Dental disease may be likened to a contaminated water supply. It retards progress. It is a menace to the health of the public. It is a disturber of the economic status of the community. It clogs and corrodes the conduits. It is a detriment to mental efficiency, and prevents multitudes from attaining their highest usefulness to the state, and to the nation."

These definitions of dental disease from laymen are sufficiently comprehensive, and the similies sufficiently impressive, to show us that our efforts during the last twenty years to educate the general public have, in some measure at least, been effective.

In this paper, I shall attempt to adhere strictly to my subject. I am going to analyze the various organizations through which oral hygiene work might best be carried on, and finally, tell you something about the work that we are doing in Canada, and what measure of success has attended our efforts there.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

†Field Secretary, Canadian Dental Hygiene Council.

I am taking for granted that it is not necessary for me to define what I mean by oral hygiene. That has already been defined several times at this meeting, and I am going to leave it to you to interpret it, in either its broadest or its narrowest sense, just as you choose. For, in either case, my argument must be the same.

Nor am I going to enlarge on the need of oral hygiene educational work. What has been done is history, what has been left undone is a tragedy.

We are no longer so greatly concerned about the subject matter that we will present, other than that we should endeavor to avoid exaggeration. We must present facts based on scientific investigation. There are sufficient of these to convince the most skeptical.

What we are concerned over at the present time is the best method of presentation and what organization is best suited for that purpose.

It is a very healthy sign that, just now, we seem to be in the midst of a wave of enthusiasm for oral hygiene educational work. This new interest is not confined to our recent graduates, who are better equipped for this work than we were; nor is it confined to our local and state societies. It is not confined to the profession at all. It is cropping up here, there and everywhere. From dental supply houses; manufacturers of dental material and equipment; makers of dentifrices, toothbrushes and toilet soaps—in fact, from all branches of trade, commerce and industry—we hear whisperings and suggestions that, with very little effort on the part of the profession, money, and money in large sums, might be available, under certain conditions, with which to carry on mouth health educational work.

This may be a good sign, but let us be sure that we neglect no opportunity to investigate carefully the details of all such overtures, sift them thoroughly, retaining and making use of only what is good, attempting to set right those who, through enthusiasm and good intention, fail to observe the matter in its proper setting; discarding any offers that show the marks of selfish endeavor or mercenary motives. Let us accept these manifestations of interest in oral hygiene educational work as a sign of the times, realizing that public conscience has been awakened.

NATIONAL ORAL HYGIENE

Oral hygiene educational work might well be established on the premises that it is a public welfare project. It might well be placed on the same organization basis as are all other branches of public health, and the various bodies functioning to promote public health, such as the Red Cross, Child Welfare, Tuberculosis Association, Mental and Social Hygiene councils. While all of these are public health bodies fighting the ravages of disease, they are not entirely inspired, nor is the active work carried on by the profession of medicine. They are all national organizations administered by public spirited citizens, men and women with altruistic vision, giving generously of their time and money to promote the common good. These are all national organizations.

The national menace of dental disease can be largely overcome through education. Who is responsible for this duty and under what auspices can this education best be carried out? Surely not through the narrow boundaries or scope of the dental profession but through a nation-wide voluntary lay organization.

Through a national public health organization, it is possible to coordinate all endeavor. It would provide a clearing house for material, equipment and method of presentation. It could assist the weaker state societies by taking to them the details of methods employed successfully in the stronger and larger state societies, and it could supply inspiration, assistance in organization and workers. It could keep its finger on the pulse of national public opinion. It would keep itself familiar with the federal government's attitude along public health lines. It would have national headquarters.

It is true that good work has been accomplished and splendid results have been achieved up to now, through the efforts of local, community or state societies. You have heard reports at this meeting of many of these, and we are all proud of them. But this work has been inspired largely by a few enthusiastic dentists, or groups of dentists, with a vision. These groups, or individuals, tire and become discouraged unless there is a coordinated response to their endeavor. Wonderful results have been achieved through state recognition, and the establishment of dental divisions in the state departments of health, in the Province of Ontario, in our own Dominion, and in eighteen states in your country. As to results, I can speak proudly of the work that has been accomplished under the director of dental services in the Province of Ontario. Here, the greatest harmony has prevailed between the minister of health, the director of dental service and the dental society of the province. These three working together have accomplished results which could provide material for a much longer paper. I am sure that equal success has attended the efforts in many of your states.

But could not a national lay organization, fortified with the knowledge of the successful results achieved and the story of the state cooperation accorded in these few centers, enthuse and inspire many more of the state government officials and state dental societies to greater efforts?

You will say, "But we already have national organizations in the American and Canadian dental associations. Isn't it their right and duty to do this work?"

Yes, it is their right and duty. But can this work best be done by a purely professional organization? I will say, "No!" It has been proved over a number of years that public health activities have been most successfully carried out by joint lay and professional bodies. Oral hygiene work as a public health measure might well be subject to the same administration.

Let us consider the various public health bodies as we know them. I will name some of them again. The Tuberculosis Association, the Red Cross (Peace time Program), Child Welfare, Mental Hygiene and Social Hygiene councils. These organizations are administered and their policy controlled by the most outstanding public men and women of our land: individuals with a broad humanitarian outlook; executives with experience in handling big business; financiers and philanthropists, who have time and money to devote to public welfare, as well as the highest officials of our government and national life. Could the Tuberculosis Association ever have reached such heights of service through an organization administered and promoted by the medical profession solely? Would not oral hygiene, as a public welfare measure, be better carried out through the counsel and active cooperation of such men and women?

With a combined professional and lay organization, we would greatly increase our contacts, broaden the scope of our work and create for it a public opinion that can never be created by a purely professional organization. It commands the support and cooperation of other public health and welfare bodies much more spontaneously than would a purely professional one. We are all human after all, and where a purely professional organization is concerned, there is bound to be some criticism that it is promoting its own ends, particularly when the profession of dentistry itself promotes oral hygiene educational work. True, this criticism is heard less frequently than in former years, but in order that we may be entirely free from it, and in order that this work shall be expanded to its fullest measure, let us see to it that it is directed through the proper channels. Then oral hygiene educational work shall take its rightful place and do its greatest good.

With such an organization, let us hope that, in twenty-five years, it will have established a history and tradition as glorious and effective as have the agencies that are responsible for the wonderful work done for tuberculosis; the broad peace-time program of the Red Cross; the splendid humanitarian efforts of the Child Welfare Council, as well as the noble work done by the Mental Hygiene Council and the gratifying results achieved through the activities of the social service councils.

This does not mean another dental organization, but rather another public health body. It does not take away any of the duties of our national or state societies, but allows them the opportunity, through a broader organization, to do a greater service.

Such an organization must be affiliated with the national dental association, with the national oral hygiene committee, and it must be supported and aided by every state society.

The profession of dentistry must have a prominent part in every oral hygiene educational effort. Unlike many other diseases, dental caries is not curative. Nature has provided no method of restoring teeth structure lost through decay. In many of the diseases of the body, rest, sunlight, fresh air, quiet, proper diet and sanitary measures will bring about a cure. But not so in dental caries. The dentists must have a part in every effort to restore to normal a person who has suffered from dental disease. For this reason, it is very important that the profession be represented in every organization for the promotion of better mouth health.

The profession must carry on research work and scientific investigation and prepare the data thus established in readable form for the public. The profession must provide clinical pictures and experience, and stand back of any effort, either financial and executive.

The success which has attended the efforts of the Canadian Dental Hygiene Council has more than justified its existence and has convinced the promoters of that council that the premises on which it was established were sound, and these are that oral hygiene educational work should be nation-wide in its organization, that it should be carried out by a national body and that this body should be a voluntary one, jointly lay and professional, rather than a purely professional one.

The Canadian Dental Hygiene Council is a national organization, endorsed by the Canadian Dental Association and all of the provincial dental societies. Its executive body is made up of representatives from every province in the Dominion. This national aspect is further manifested in its financial structure. It

receives an annual grant from the government of the Dominion of Canada at Ottawa, an annual grant from the Dominion Red Cross, from the Canadian Life Insurance Officers Association, from the Canadian Oral Prophylactic Association and from various other philanthropic and charitable bodies.

This national council is a voluntary organization composed of laymen with a subcommittee of dentists to establish dental contact. The leading officers of the council are laymen. The president is an outstanding lawyer, a general who was minister of militia in the federal government during the World War. Our vice president is the general manager of one of the largest life insurance companies in the Dominion. On our executive council, we have the Dominion Red Cross representative, who is a prominent engineer, a colonel who was connected with the Department of Sanitation and Water Supply of the British Army during the World War. Another member of our executive committe is the editor of one of the foremost newspapers in the Dominion.

These men are busy men, men who have been active for years in public health and social welfare work, men who have been concerned in every important health movement in Canada during the last five or ten years, yet they are so impressed with the importance of this health movement in Canada and with the importance of oral hygiene educational work that they willingly give of their time and money to promote the welfare and program of the Canadian Dental Hygiene Council. To this executive council is added one dentist from every province.

This review of the personnel of our organization is here given in order that you may be impressed with the fact that the Canadian Dental Hygiene Council is a national and voluntary organization in the truest sense.

The chief aim of the Canadian Dental Hygiene Council is to initiate oral hygiene work throughout every province of the Dominion and, during intensive, province-wide campaigns, to impress the government and those high in authority that they should take the responsibility of continuing this work, and that oral hygiene should become a part of the program of every organized health department, whether it is civic, municipal or state.

The method of functioning of the Canadian Dental Hygiene Council has been to organize one province at a time, working through the dental society or provincial oral hygiene committee as a nucleus. We endeavor to obtain the cooperation first of the provincial government, particularly the departments of health and education, and this, in every instance, we have attained.

It is most important that any health campaign be carried out under the auspices of the department of health of the province. It brings added prestige; in some cases, it provides additional financial assistance. It means the assistance of the various medical health officers throughout the province, in an authoritative way. It provides speakers on general health subjects to round out a program of a meeting to the general public.

The active assistance of the provincial department of education is absolutely necessary. In any province-wide campaign, our greatest effort is centered on the school child. An address of not more than fifteen minutes is given in every school room, or it may be given to an assembly of school children. This is made possible through the cooperation of the department of education. A special address is given to the school teachers, whose

interest has been previously enlisted by a letter from the minister of education.

The cooperation of the provincial Red Cross is very desirable. This is always freely given, and has proved most valuable. An entrance is gained through the Red Cross to many of the local welfare societies. The interest of the various women's societies, such as the Women's Institute and the National Council of Women, is also desirable, and establishes for us a contact with the mothers and homemakers, which is invaluable in these province-wide campaigns. Literature, specially printed books, highly colored and well illustrated, is distributed to children from 6 years of age up and to adults. A large number of moving picture films are employed, and the interest of the theatre owners is such that they have willingly granted the use of their theatres on Saturday mornings. It has not been difficult to induce them to run a short trailer on every program during the days of the campaign.

The cooperation of the newspapers is essential if we would have the desired publicity for our efforts. In the Province of Manitoba, where the Canadian Dental Hygiene Council carried on an extensive mouth health campaign early this year, 106 newspapers each carried a series of five special articles on oral hygiene which had been especially prepared by our educational committee. During the campaign in Saskatchewan, in 1928, an arrangement was made whereby 250 newspapers in the western provinces engaged to carry a series of eighty articles, one each week, especially prepared by our educational committee, on oral hygiene.

Through a lay organization, this newspaper help and cooperation has been freely and generously given; through a purely professional body, it would be impossible to obtain it without financial outlay.

Through a national lay organization, the dentist himself is inspired to greater service. He is not fettered by the fear of criticism that would come through a purely professional effort. He finds himself one of the noble army of health workers in the great crusade for better health, not as a dentist but as a citizen.

Mouth health is not a problem solely of the profession of dentistry. It is a problem of the individual, the home, the school, the city, the municipality and the state. It is linked with efficiency, success, happiness and citizenship.

It is allied with the effort to control tuberculosis, cancer, to promote child welfare, mental hygiene and social hygiene. These are, in fact, all parts of the same problem—better health, and better health is largely a matter of education, so let us see to it that the profession of dentistry give itself earnestly to its share of the task in solving this problem. Let it encourage its scientists and research workers on to greater efforts to provide data and material to its best writers and thinkers that they may provide literature and discussion that will be enlightening, and inspire to action, until that time arrives when every man and woman, every boy and girl, in your land and my land, will know that mouth health means better general health, that dental disease leads to general disease, disaster and sometimes death. That dental decay is preventable, and the greater part of this prevention is education.

Let us tell them that this prevention depends largely on conforming to simple rules of life and changed habits of living, so that every child shall enjoy that God-given heritage of better health that will enable him, in the future, to attain his

loftiest aspirations. And might this not be done better through an organization administered by business people with a broad humanitarian outlook, an organization that commands a closer contact with governments, philanthropists, the general public and other health bodies? Then, I think, oral hygiene education work shall reach its greatest heights, and the results achieved will be our reward.

PREVENTIVE DENTISTRY AS REFLECTED IN THE WORK OF THE PUBLIC SCHOOLS*

By U. L. GORDY,† Chambersburg, Pa.

MY treatment of the subject, "Preventive Dentistry as Reflected in the Work of the Public Schools," will be confined to the care taken of the teeth of the children in the grade schools of Chambersburg, Pa., during the past seven years. I have had no further experience, though my interest was aroused in 1912 by B. M. Loar, that year president of the Pennsylvania Odontological Society, when he called my attention to an experiment made by Dr. Ebersole with a selected group of school children in Cleveland, and reported in *Oral Hygiene*. After Chambersburg's story in this matter has been told, each may draw his own conclusion, as I have drawn mine.

In order to estimate properly the value of the work that we have done in this field, as it may reasonably apply in other communities, it may be well to know that Chambersburg is the county seat of Franklin County, surrounded by the fertile farms of the Cumberland valley. The population is approximately 15,000. Iron and textile mills employ the labor. There are no rich, few foreigners and about 1,000 negroes. In the school year 1928-1929, 2,295 children were enrolled in the grade schools. Of these, 2,233, or 97.4 per cent, had teeth in perfect condition, that is, the teeth were clean and all cavities properly treated as certified by practicing dentists in the city. The teeth of the remaining sixty-two children, or 2.6 per cent of the entire enrollment, were either dirty or in the process of decay, probably both.

The first move in dental hygiene service in the Chambersburg public schools was made by C. J. Hollister, chief of the dental division of the Department of Health of Pennsylvania, when, in September, 1921, he sent a motor dental outfit to the city, in charge of a registered dentist and a dental hygienist. They worked for two weeks, free of cost to the children, filling and cleaning the teeth of an unselected group of thirty fourth-grade children, who ranged in age from 8 to 11 years. Two of these children were found to need no work. The remaining had unclean teeth, and from one to twenty cavities each. The average was five cavities.

Report of this was made to the school directors, and was published in the local

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

†Superintendent, Public Schools.

newspapers, with the result that the Women's Civic Club of Chambersburg volunteered to underwrite to the amount of $300 the expense of dental hygiene service in the public schools for the remainder of the school year. The proposal was accepted on the grounds that the public schools ought to provide for the children what the public desires for them. Jan. 12, 1922, a graduate dental hygienist was employed at the salary of $100 a month. The following equipment was bought: portable chair, $80.00; instruments, $21.95; stand for instruments, $42.00; sterilizing bath, $33.75; materials, $17.35; total, $195.05.

A few days later, the hygienist arrived in Chambersburg. She went promptly to work and has remained on duty to the present time, working with the original equipment. Her salary has been gradually advanced to $1,600 a school year of nine months. The only additional expense of this department in our schools has been for materials, varying from $10 to $15 a year. No other subsidy has been received since the donation by the women's civic club. The entire cost is paid out of the general fund of the school treasury.

As in any other worth while undertaking, it seemed important that a policy to govern our procedure in this project be adopted at the beginning. We agreed that bad teeth are largely the result of personal neglect, and not a divine visitation as many apparently think. In consequence, our problem seemed to be to educate the children to a sustained desire to have good teeth, and the precautions and habits necessary thereto. We have made no change in this policy. Clinical service to the individual child is an incident, not an end, in our dental hygiene program. The most important consideration is that it affords the hygienist one of the several opportunities required to educate the child to desire good teeth.

It means a great deal to a child to have clean teeth, though some may not be sound. It is to him an agreeable experience and one which makes his further progress in dental sanitation comparatively easy. For that reason, our hygienist spends relatively three fourths of her time at the chair. Her remaining time on duty is devoted to visiting schools for the purpose of instructing all the children in the proper care of teeth. She reported at the end of the school year 1928-1929 that she had cleaned the teeth of 907 grade-school children, or more than one-third of those registered. These children were selected in tolerably even ratio from the fifty-nine schools, housed in seven buildings. As a matter of convenience to the children, and to insure that a timid child will not refuse to go when called out of familiar environment to the operating chair, the equipment is set up in the building in which the children attend school. It is easily transferred from one building to another. A rest room or corridor properly screened is the clinical office. If any child or parent objects, the service is withheld. Few such cases have occurred. Whatever contention has arisen in this particular has been the result of failure to select the child for service.

It requires, on an average, thirty minutes for the hygienist to clean a child's teeth by hand. At one time, we considered the advisability of including a motor in our equipment, in order that a greater number of children could be treated. The plan was abandoned when it seemed probable speed would tend to defeat our major purpose — education. When a child's teeth have been cleaned, record is made of his condition when called to the chair, the number of cavities, whether he possesses a toothbrush,

etc., and this record filed. We decided that it would avail little to report to the parent with the expectation that what is needed in the way of home care and dental service would be provided. Medical inspectors had done this for years in Chambersburg before Dr. Hollister's assistants discovered in 1921 that twenty-eight of thirty school children were victims of dental illness. It seemed certain that effective leverage had to be sought at another quarter. Our final conclusion was that the power of this leverage must of necessity be centered in the child.

It often happens that failure or only meager success follows well-meant undertakings in human welfare because certain cardinal principles in the social equation are overlooked. For example, some years ago, a government commission inspected the company houses of a large industrial plant in Pennsylvania, and ordered bath rooms installed in the homes of all workers. This was promptly done. Some time afterwards, a reinspection was made, and many of the bath tubs were found to be used for potato bins. The difficulty in this case was that the sanitary consciousness of these hard-working people was low. Mental attitude is the keynote in all personal activity, in oral hygiene as in the daily bath.

One more digression that will explain what is to follow: Any teacher worthy of her position knows that individual pride and self-respect are the most effective motives to right effort on the part of her pupils. On these grounds, no child in the Chambersburg schools is reprimanded in the presence of his classmates. No children are kept in at recess for unprepared lessons or violation of rules of conduct. The blackboard contains no list of delinquents. On the other hand, at the end of the month, an honor roll for noteworthy performance in lessons and deportment is posted in the room, and a copy sent to the superintendent's office. The local papers are glad to publish this list of names as a news item. Each child has an allotted place on the bulletin board in his room for posting written work approved by the teacher. This is frequently inspected and commented on by the principal and the superintendent when they visit the room. Many other such devices are employed to provide the necessary urge to school children in Chambersburg to do their best in everything, and 95 per cent of them do it. The records of the remaining 5 per cent are accepted as unavoidable, and the children are made as inconspicuous as possible, and regarded as objects of pity rather than of censure.

This policy in general administration is carried into our department of dental hygiene. While the hygienist is operating on the child, no word of unfavorable comment is made about the condition of the teeth, however bad this may be. No terrifying prophecies are made about the consequences of neglect. The personal reflection of a life-time, implied in the case of those who have artificial teeth, is not mentioned. Much is said about the advantage of having good teeth—how they affect health and improve personal appearance. (Our hygienist has beautiful teeth and is otherwise generally attractive.) The child is diplomatically told, before he leaves the chair, how to care for his teeth, and how important it is that cavities be promptly treated by a dentist.

Cooperating with the hygienist, all teachers establish in their rooms a "Perfect Condition of Teeth" roll, membership to which is earned by the pupil when he brings to his teacher a certificate from his dentist, stating that his teeth are clean

and all cavities have been properly treated. The official form reads:

PERFECT CONDITION OF TEETH

Chambersburg, Pa.,.....192...

This certifies that I have this day examined the teeth of.....and find they are clean and all cavities properly treated.

.....

D.D. S.

This is printed at the expense of the school district, and supplied free of cost to all practicing dentists in the city. The roll of pupils who have brought certificates is made on the blackboard at the front of the room, and the names are written in the order in which the certificates are handed to the teacher. Sometimes, the teacher, or a talented pupil, displays a lot of artistic skill in ornamenting a 22 by 28 inch cardboard for this roll. I have here one such roll. Applause by his classmates invariably follows the bringing of a certificate. The superintendent, principal and hygienist, when visiting a room, frequently take time to call the "Perfect Condition of Teeth" roll. It is rather amusing to see with what zest a boy snaps out of his seat, and stands at an erect posture, when his name is called.

Utilizing the power in the spirit of rivalry to stimulate dental treatment among school children, before the damage of neglect has reached in adult age a point beyond correction, a high room card is provided for each building. This card is hung on the corridor side of the door for the school having the highest percentage of pupils enrolled that have brought "Perfect Condition of Teeth" certificates. This card has been known to change rooms several times in a single day. The children in the public schools of Chambersburg understand percentage, it seems to me, better than any other rule in arithmetic. A first-grade child 6 years of age, will tell you promptly and correctly what 100 per cent means. A fourth grade child, just mastering long division, will solve his own problem by computing the advance made in per cent for his room by the "Perfect Condition of Teeth" certificate that he has brought.

A school in Chambersburg first reached 100 per cent enrollment in perfect condition of teeth, March 12, 1925, or approximately three years after the beginning of dental hygiene service. A card announcing the event was prepared and with due ceremony presented to the school. This is always done when a room reaches 100 per cent. These cards likewise are suspended on the corridor-side of the door for rooms earning them. Our first 100 per cent room was a sixth grade. The teacher of the school, the principal of the building, the superintendent and the hygienist are all certified as having teeth in perfect condition. Four colored children attended that school.

In all, thirteen rooms reached 100 per cent enrollment (perfect condition of teeth) that year (1924-1925). A few days before the close of school for the summer vacation, those who held "Perfect Condition of Teeth" certificates paraded through the central streets of the city, preceded by a traffic escort and the high school band. Such a parade is held at the close of each school year. I have a movie film made of the 1928 parade. It is easy to see by the crowded sidewalks that the parents and friends of the school children approve of dental hygiene service. In fact, it is, I believe, one of the last features of our public school program the patrons would permit to be discontinued.

When a teacher has enrolled her pupils 100 per cent perfect condition of teeth, report of this is made to the school directors by the superintendent, with the recommendation that she be commended for

the service. This is always done, and the action written in the minutes of the meeting, and published in the local papers along with other proceedings. A letter is written to the teacher by the secretary, notifying her of the board's action. I have one of these letters. It reads:

Chambersburg, Pa., Nov. 13, 1928.

Miss Cora M. McKeehan,
257 Lincoln Way East,
Chambersburg, Pa.
My Dear Miss McKeehan:

At the meeting of the school board held November 8, a resolution was passed commending you for having registered your pupils 100 per cent perfect condition of teeth.

Fidelity of service of this type, in any phase of school work, merits and receives the highest approval of the school board.

Yours very truly,
W. R. Appenzellar,
Secretary.

Many of our teachers have received one of these letters, each year, for the past three or four years. I find that they are treasured as valuable keepsakes. If any one thinks that he sees some practical psychology back of this procedure, I shall not dispute the claim.

The accompanying table shows at a glance the progress in dental hygiene service in the Chambersburg public schools from January, 1922, to the close of school, June, 1929.

Great credit is due the ten practicing dentists in the city for making this progress possible. Despite the fact that children of preadolescent age are, as a rule, troublesome patients, the dentists in Chambersburg have cooperated with us nobly and faithfully in putting this program across. Of course, they did not give their service for nothing. I suspect it often happened that their fees were very small.

It is our custom in Chambersburg to promote pupils on the last day of school before the summer vacation, sending them for registration in the rooms that they will attend next year. After this has been done, and the pupils are made to feel that they will have a fine school to go to next year, the teacher asks, the last thing before final dismissal, that as many as possible bring perfect condition of teeth certificates the first day of school the next year. Usually, there is a 100 per cent raising of hands by pupils, pledging themselves to do this. On the opening day of school this year, 466 certificates representing 22 per cent of the grade pupils registered, were handed to the teachers. All certificates were dated after June 9, 1929, the closing day of last term.

PROGRESS IN DENTAL HYGIENE IN CHAMBERSBURG SCHOOLS*

	1922	1923	1924	1925	1926	1927	1928	1929
Perfect Condition of Teeth Certificates.....	129	361	645	1,641	1,904	2,075	2,151	2,233
Per cent perfect condition of teeth.....	6	16	28	73	85	92	94	97
Rooms 100 per cent.....	0	0	0	13	20	35	42	48
Buildings 100 per cent (8 or more rooms).....	0	0	0	0	0	2	2	3

*From January, 1922, to June, 1929.

Some critical philosopher is likely to rise and charge us with low motivation in our dental hygiene work. We admit that it may not be the highest, but insist that it does move. The school children in Chambersburg have clean teeth. They go to their dentists at least once a year for any treatment needed. A middle-aged man, prosperous in a large business, told me some time ago that he had intended for several years to visit a dentist, but just had not "got started." His teeth looked the part. Will some one suggest a high working motive for this man? His

may not have been an exceptional case. Dr. Loar surprised me in 19.2 by saying that the cities in Pennsylvania would not be 25 per cent manned with dentists, if every person had the proper attention given his teeth. As president of his association in the state, he undoubtedly knew what he was talking about.

What does all that has been said about dental hygiene in Chambersburg grade schools have to do with preventive dentistry? A great deal, it seems to me. In my long experience as a school man, it was once not uncommon to see school children with badly stained teeth, often in an advanced state of decay. Many had lost their front teeth, or needed extractions. No such conditions exist among Chambersburg school children at the present time. At the opening of our high school, this September, a survey was made of the teeth of the 919 students enrolled. Of these, ranging in age from 12 to 20 years, 626 are resident students who have come up through the grade schools of the city, and have had the benefit of at least three years of dental hygiene service. The remaining 293 are from rural districts that have not had dental hygiene in the schools. The following brief statistics indicate the difference between a dental hygiene program and no program in the schools: percentage having perfect condition of the teeth: city, 87; rural, 38; percentage having had teeth extracted: city, 25; rural, 63.

The claim cannot be made that home finances and the status in the social scale are factors in this advantage of the city student. The statement has already been made that Chambersburg is surrounded by fertile farms. Our rural folk are alert and able in providing themselves with such good things as they desire. Their homes are more substantially supported than the average home in our city. Yet our poorest school children in the city have their teeth put in proper condition once a year, while few rural children, in more affluent circumstances, do this. Dentists' fees are somehow provided. When money from parents is not available, collection and sale of junk, after-school chores, and other such measures are resorted to. I know of one case in which a colored girl, 16 or 17 years old, ward of the probation court, borrowed from her teacher enough money to get her "Perfect Condition of Teeth" certificate, and paid it all back, in amounts sometimes as small as 2 cents. It has happened that teachers have given out of their own pockets at least some of the money required for needy children; but this is now forbidden.

Such intensive impressions are certain to influence habits of living. Our children, when they reach adult age, will not only have avoided the damage done to teeth by neglect, and the need of extended dental service, but will also be careful to give and have given proper attention to their teeth as long as they live. The same will be true in any other community where serious effort is made to maintain a program of education in dental hygiene as a part of the instruction given in the public schools. These eventualities constitute my answer to the inquiry as to what the public schools may do in preventive dentistry.

CONGRATULATE OHIO

Ohio has just stepped into the rank of those states having a full-time director of dental hygiene. An appropriation of $10,000 has been made available to the state department of health for dental hygiene work and, as a result, Charles A. Neal, state director of health, has established a bureau of dental hygiene in his department. Efforts will soon be made to outline a program of activities for this new bureau.

L. G. Bean, of Athens, Ohio, has been chosen as director of this new department. Dr.

Bean is well qualified for this responsible positions, as he holds the degrees of B.Ped. and Ph.M. from Ohio University, and D.D.S. from Western Reserve Dental School. Furthermore, he has been in the general practice of dentistry for several years, during which time he has taken five postgraduate courses covering various phases of dental practice. Included in these courses is the visiting staff course at Forsyth Dental Infirmary. He is also a World War veteran, having been honorably discharged in 1919, with the rank of captain.

Ohio is to be congratulated on this happy advancement in her health activities. The state has long been considered a leader in mouth hygiene endeavors and the establishment of her new bureau of dental hygiene strongly emphasizes that leadership. No small credit should be given to the state dental society and to the state director of health for this achievement.

BUREAU OF CHEMISTRY

LAVITA

HOW many dentists would be impressed with the claim that pumice mixed with soap will prevent and cure pyorrhea? Hardly any, to be sure. Nevertheless, the propaganda of the Lavita Company of Waterloo, Iowa (formerly of Minneapolis, Minn.), gives the impression that the product, Lavita Dental Powder, will do just that and more. As shown further on in this report, the A. D. A. Chemist examined Lavita Dental Powder and showed it to consist essentially of pumice and soap. At $2.50 for 3 ounces of the product, it is little wonder that the Lavita promoters should wish to create a demand for it, as the profit from the sale of each can must be tremendous, even allowing for a large overhead.

The cost is of minor importance compared to the danger to the public health from promiscuous use of a preparation of this kind, and the advertising claims built around it. In this apparent disregard for the oral health of the public, the Lavita promoters apparently are aided by one Lynval E. Davidson of Kansas City, Mo. Under Dr. Davidson's name appears a professional testimonial recommending to the profession, and through them to the public, the use of Lavita in cases of pyorrhea. One wonders if Dr. Davidson was aware that he was countenancing for daily use a preparation which is over 80 per cent pumice. Concerning pumice in dentifrices, the writer of a well-known textbook on dental materia medica states:

> Pumice stone is a light, porus stone of volcanic origin, consisting chiefly of silica, with potash and soda. As may be expected from its composition, it is a powerful abrasive, and it should never enter into a tooth preparation intended for daily use. Even its temporary use in conjunction with precipitated chalk acts deleteriously on tooth structure.

The harmful effects which would follow the daily use of a powder containing pumice is quite aside from the question of the dental ethics involved in giving a testimonial for such a secret preparation. The code of ethics of the American Dental Association states:

> It is unethical for dentists to give testimonials concerning the supposed virtue of secret or proprietary remedies, vaccines, mouth washes, dentifrices or other articles or materials which are foisted on the public, claiming radical cure or prevention of diseases by their use.

That dentists should allow their names to be used in connection with the exploitation of such "cure-alls" is a direct violation of the code of ethics. Such practices are frowned on by those members of the profession who regard highly the finer purposes and ideals of dentistry.

Here are some of the statements which appear in Lavita advertising:

> Regardless of the stage (incipient or advanced) of any case of gingivitis, pyorrhea, etc., we urge every individual to:
>
> 1. Begin at once the use of Lavita dentifrice and continue its use as your exclusive dentifrice. Discontinue all pastes or other dentifrices.
>
> 2. Consult your dentist for complete djagnosis, and if there be any indication of gingivitis, pyorrhea, or any oral infection, arrange

for him to administer professional Lavita treatment before extracting live teeth.

A slight concession is made to the profession—after the public has bought Lavita. But, even then, the Lavita promoters would limit the dentist in his choice of treatment by having the patient arrange for his dentist to administer professional Lavita treatment. This is another subterfuge of promoters to force their product on the profession—by having the patient tell the practitioner what

Fig. 1.—Lavita container.

to prescribe. It is an insult to the intelligence of a competent profession for a manufacturer to suggest to the public that the public in turn suggest how the dentist shall treat disease conditions of the teeth and gums.

One wonders what psychologic process led the manufacturer to believe that scientific dentists are willing to share in such a partnership. This is what certain promoters of dentifrices and other oral preparations designate cooperation with the profession, booming their product at the expense of the profession's reputation. Progressive dentists repudiate this sort of "cooperation."

Lavita Dental Powder is more than a dentifrice. if one is to believe the advertising. The following claims appear:

Prevents—Corrects—Controls: Gingivitis, Pyorrhea, Halitosis, Loose Teeth, Trench Mouth, Cold Sores, Gum Boils, Cankers, Irritation by Dentures.

And thrown in for good measure—

Fig. 2.—Photomicrograph of pumice separated from Lavita Dental Powder. (× 180.)

"Avoid Tooth Paste containing glycerine, which softens the gums and encourages the growth of bacteria." Possibly, Lavita promoters forgot for the moment that their product was over 80 per cent pumice, the daily use of which is not considered harmless.

It is news for the profession to be told that a mixture consisting essentially of pumice and soap would cure pyorrheic conditions. It is more in keeping with

experience to state that the continued use of a mixture containing as much as 80 per cent of silicious material will eventually lead to harmful, abrasive action, not only to the teeth but also to the gums. Such a mixture will not prevent, let alone cure, "pyorrhea" or other gum disorders.

In the light of the chemical examination, the directions for the use of this dental powder appear to be not only irrational but also contrary to chemical knowledge regarding the insolubility of pumice:

> Do not rinse mouth after using Lavita. The residue remaining after use is of great value in its reaction and to correct Mouth and Gum disorders. Let it remain and dissolve.

Dentists are not aware that pumice is soluble in saliva. Pumice, of which Lavita is principally made up, is, as is well-known, insoluble in strong mineral acids, let alone in saliva. Possibly, the Lavita Company can explain by what magic process pumice was treated to make it soluble in saliva.

The ridiculousness of the quoted claims for Lavita are further apparent from the examination of this "pyorrhea cure-all" by the A. D. A. Chemist.

A. D. A. CHEMIST'S REPORT

"Original cans of Lavita (Lavita Company, Minneapolis, Minn.), price, $2.50 each, were submitted to the A. D. A. Bureau of Chemistry for examination.

"The contents of two cans were bulked and mixed. Each can contained 100 gm. (approximately, 3.2 ounces) of a finely divided, grayish powder, possessing an odor suggestive of oil of cloves and oil of cinnamon. The powder was gritty to the touch and had a soapy taste. The greater part of the powder was insoluble in hot water and in mineral acids, although the following appears on the can: "Let it remain and dissolve." Closer examination indicated this insoluble matter to be pumice, which was confirmed by petrographic determinations. Figure 2, a microphotograph of the acid insoluble material, is attached.

"Qualitative tests indicated the presence of combined "fatty acid," carbonates, iron, sodium and potassium. Mercury and other heavy metals (except iron), calcium, magnesium, alkaloids, chlorids, idodids, borates, sulphates, phosphates, phenolic compounds and starch were not found. Oxidizing agents, such as perborates, peroxids, chloramin and dichloramin were not found.

"Quantitative determination yielded the following:

Loss at 100 C. "Moisture" and volatile oils	2.20 per cent
Ash	87.40 per cent
"Sulphated Ash"	90.80 per cent
Pumice (acid insoluble)	84.00 per cent
Iron (Fe^{+++})[1]	0.07 per cent
Sodium (Na^{+})[2]	1.96 per cent

"From the foregoing, it may be con-

1. The iron probably arises from the acid treatment of the pumice. It is unlikely that iron compounds were added in view of the insignificant amount found.

2. The combined amount of sodium and potassium as found is higher than that accounted for by carbon dioxid and "fatty acids." This is not surprising in the light of the analysis. "Soap" generally is not a single chemical entity but a mixture of one or more fatty acids, prepared by the saponification of animal or vegetable fats, usually with sodium or potassium hydroxid. The ultimate composition of "soap" has not the same constancy of character as sodium chlorid, sodium bicarbonate, etc. It is not improbable that part of the sodium and potassium arise from the action of acid on the pumice.

3. The composition of the tooth powder is similar to some of the scouring and washing powders on the market.

4. The sodium bicarbonate is calculated directly from the determined amount of carbon dioxid.

cluded that Lavita Dental Powder contains essentially[3]:

Pumice	84.20 per cent
Soap	9.80 per cent
Sodium bicarbonate[4]	1.90 per cent
Potassium (K^+)	0.19 per cent
"Fatty acids"	8.90 per cent
"Soap"	9.80 per cent
Carbon dioxid (CO_2)	0.98 per cent

MISCELLANY

BOOK REVIEWS

The Making and Filling of Cavities in the Proximal Surface of the Front Teeth with Gold Foil. By Charles E. Woodbury, D.D.S., F.A.C.D., LL.D., Council Bluffs, Iowa. Professor of gold foil, Dental Department of Creighton University, Omaha, Nebr. Pages, 118. Price, $5.00. Published under the sponsorship of the Woodbury Study Club of Omaha, Nebr.

The outstanding position that Dr. Woodbury has achieved as a gold foil operator makes this book command at once our attention and respect. Anything that he says on this subject must be looked on as orthodox, and at a time in our professional history when the virtues of gold foil have been more or less forced into eclipse, such a book is greatly needed.

The plan of the book is to print an illustration of a given operation on a full page with a description in text on the opposite page. This plan lends itself very readily to the most lucid presentation of the subject, and makes clear every step of the operation. A student, even with little knowledge of the subject, can easily visualize the various procedures, and the experienced operator will find his work systematized and made lighter by following the technic presented in each case.

The members of the Woodbury Study Club are entitled to the thanks of the profession for their initiative in inducing Dr. Woodbury to bring out this book. Without urging on their part Dr. Woodbury probably never would have issued the book, and this would have been a loss to the profession and the world.

The book is printed on excellent paper and the mechanical work is very attractive. We bespeak for the volume a hearty reception by the profession, because a book of this kind is needed today as never before.

American Illustrated Medical Dictionary. A Complete Dictionary of the Terms Used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, Nursing, Veterinary Medicine, Biology, Medical Biography, Etc. By W. A. Newman Dorland, M.D., Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association. Fifteenth Edition, Revised and Enlarged. Octavo of 1,427 pages, 525 illustrations, 107 of them in colors; Philadelphia and London: W. B. Saunders Company, 1929. Flexible binding, plain, $7.00 net; thumb index, $7.50 net.

The present edition of this standard work comes to us in a much improved form. More than 2,000 new words are included, and a point is made of such items as capitalization and pronunciation, which are matters of importance in any dictionary of technical terms. Mechanically, the book is very attractive and most acceptable with its extreme flexibility and rich binding. Such a work as this is indispensable for the student, and in view of the rapid evolution of scientific terms at the present time, it becomes equally indispensable for the practitioner who has any ambition to keep at all abreast of the times.

NEWS

Annual Report of the Gorgas Memorial Institute: This report, which has just been issued, shows that satisfactory progress is being made in various investigative projects. Reports are made on "Health Education," "Department of Mosquito Control," and the "Gorgas Memorial Laboratory." Altogether this project merits the active support of every one interested in making people "health conscious."

Society for the Advancement of General Anesthesia in Dentistry: On Monday, Nov. 18, 1929, permanent organization was effected of the Society for the Advancement of General Anesthesia in Dentistry, at the office of M. Hillel Feldman, 730 Fifth Avenue, New York City. James T. Gwathmey, M.D., was elected honorary president; Dr. Feldman,

D.D.S., president; James T. Ivory, D.D.S., Staten Island, N. Y., vice-president, and Leonard Morvay, D.D.S., of 76 Clinton Avenue, Newark, N. J., secretary. The purposes of the Society are set forth in the constitution as follows: "Whereas the utilization of general anesthesia in dentistry has been neglected for a number of years, and whereas this has deprived our patients of an agent of inestimable benefit for operations in the mouth, therefore be it resolved that we, a body of general practitioners, organize to foster this purpose. The object of this society shall be to promote knowledge of general anesthesia in dentistry among general dental practitioners and to stimulate research along this line." As such, it is the only organization of its kind in the world. General anesthesia societies are usually in the interest of specialists in anesthesia. It is planned to hold quarterly meetings. A dinner of the entire society will precede each meeting. The next session is called for Feb. 17, 1930. The society pledges itself to abide by the Code of Ethics of the American Dental Association. Special mention was made in the constitution adopted of the pledge of the members not to tolerate the division of fees between general practitioners and specialists in any form.

Nutritional Research Foundation Established at Indiana University: The president and board of trustees of Indiana University announce the establishment of a foundation for nutritional research at Indiana University School of Dentistry, under the direction of Prof. Sherman L. Davis. The announcement reads:

"For a number of years this department of the university has been making a study of the causes and sources of dental caries, pyorrhea and erosion. Believing that these problems are all closely associated with nutrition and that such a study will inevitably result in the betterment of the human family, the university has determined on the foundation as the best means of making these studies, for the following reasons:

"1. By the establishment of an advisory council, to be composed of a large number of outstanding men in the dental, medical and allied professions, the foundation will be enabled to secure a wider field for observation and experiment and to profit by the knowledge and advice of those who are working in the same field.

"2. By the establishment of fellowships, we will be able to train selected persons for the carrying on of the work.

"3. Through a foundation, the facts and findings may be better distributed, both to the professions and to the public.

"4. It is to be hoped that the character and importance of the work will attract sufficient attention from those persons of philanthropic inclination that gifts of money will be offered to carry on this highly important service.

"A foundation within the university needs no special set-up or organization. It is within the constitutional powers of the university and will be administered by the constituted officials of the university."

Dr. Lischer Joins University of California Faculty: B. E. Lischer, of St. Louis, Mo., leaves, January 2, for Berkeley, Calif., where he has accepted an appointment as full-time professor of orthodontia. Dr. Lischer will retire from private practice. He has, since 1924, been a nonresident lecturer in orthodontia at the University of Michigan, and, from 1901 to 1924, was professor of orthodontia at the Washington University School of Dentistry.

Six Painless Parker Men Lose Licenses: Under this heading, the Denver *Post* states that the licenses of B. G. Savelle, A. W. Heitler, R. C. Steurwald, John Henry Miller, Joseph R. Walsh and Charles W. Patch have been revoked by the Colorado State Board of Dental Examiners on the ground that they had accepted employment by a corporation, "a gross violation of their professional duties." In addition, Dr. Miller was found guilty by the board of conducting a business "in his own name to conceal the fact that the Parker Dental System Company, a corporation, had an interest in and partial or entire control and management" of the business. The decision also found Drs. Miller, Walsh and Patch guilty in connection with a charge of false advertising and of abetting the Parker Dental System company in unlawfully practicing dentistry in Colorado. Decision in the case of the other three dentists mentioned was postponed for a year. Filing of charges followed a protracted effort of dentists to bar Painless Parker Dentist, a corporation, from practicing in the state of Colorado. Last spring, the state supreme court handed down a decision that a corporation cannot practice dentistry. Charges against twelve dentists were then filed before the board of

examiners. Subsequently, according to the *Post*, the charges against three of the defendants, A. D. Cage, Finley O. Gose and J. M. Jorgensen, were dismissed. It continues: "The board conducted a lengthy hearing in the cases of the other nine and took the case under advisement two months ago. It is understood that the reason why, in the opinion of the board, Drs. Mahurin, Quinn and John S. Miller deserve 'different treatment' is that they left the employ of Painless Parker Dentist when the complaints against them were filed. With regard to the false advertising charge, the decision handed down says in part: 'In and about the offices in which said services were rendered (the services of Drs. John Henry Miller, Walsh and Patch) and in public newspapers advertising said business, there was conspicuously displayed the statement that John Henry Miller and those associated with him used the E. R. Parker system. Said statement was used for the purpose of attracting patients to the offices and for the purpose of leading prospective patients to believe that the E. R. Parker system is a superior system of dentistry which is not used by any other dentists. In fact, the E. R. Parker system is not a system of dentistry but a system of bookkeeping and office management which does not and cannot have any relation to the quality of dental services rendered in said office. Miller, Walsh and Patch and associates do not have a superior system of dentistry. The use of said advertising is false and deceptive and constitutes a gross violation of professional duties.'"

Income of College Teachers: The General Education Board of the Rockefeller Foundation, New York, has made studies of the earnings of college teachers. The data presented in *Science* are from reports from 302 colleges or departments of universities, representing all parts of the country, forty of which were women's colleges. The data cover the salaries of more than 15,000 liberal arts teachers, ranking from professors to instructors, for the year 1926-1927. The average annual salary of these teachers was $2,958. It was the highest in the New England states and lowest in the Southern states. The average salary paid professors was $3,798, and instructors, $1,941. The average again varied with the size of the school from $4,573 for a professor in a class A school to $2,748 in a class C school. Mr. Frank P. Bachman of the General Education Board further shows that the highest average salary was in law schools and the lowest in music schools. Of the 15,361 teachers in the 302 colleges reporting, 92 per cent receive salaries of less than $5,000, and only 0.01 per cent, or sixteen teachers, receive $10,000 or more. Teachers supplement their regular earnings in different ways. Supplementary work consists of writing, extra teaching, lectures, consulting, and miscellaneous activities. The supplementary earnings of 7,072 teachers amounted to 24 per cent of their regular annual salaries. The supplementary earnings varied from less than $100 to $10,000 or more, the medium being $522. The most important factor, apparently, compelling teachers to supplement their regular incomes is family responsibility, for among 7,776 married teachers, 77 per cent supplemented their regular salaries by other work, while among 3,927 single teachers only 47 per cent did supplementary work. The study shows, Mr. Bachman says, that the salaries of teachers in the colleges of art, literature and science have increased about 30 per cent from 1919-1920 to 1926-1927. The average annual salary of teachers has risen from $1,724 in 1914-15 to $2,958 in 1926-1927. Favorable as their present financial status appears in comparison with the past, he says, present salaries remain inadequate.—*J. A. M. A.*, Dec. 7, 1929.

DEATHS

Allen, Harry Jerome, Santa Barbara, Calif.; National University (Medical and Dental Departments), Washington, D. C., 1895; died, October 6; aged 56.

Ballou, Louis L., Seattle, Wash.; Northwestern University Dental School, 1902; died recently.

Burris, C. J., Washington, Ind.; Indiana University School of Dentistry, 1907; died, November 8, after a major operation; aged 49.

Dotterer, L. P., Charleston, S. C.; Baltimore College of Dental Surgery, 1882; died recently.

Gordy, Arthur Perry, Columbus, Ga.; Baltimore College of Dental Surgery, Dental School, University of Maryland, 1897; died recently, after a year's illness; aged 54.

Hahn, O. E., Indianapolis, Ind.; University of Louisville, School of Dentistry, 1896; died recently, aged 55.

Rust, Theodore S., Meriden, Conn.; died, August 4; aged 85.

Stilwell, Frederick S., Cincinnati, O.; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1906; died suddenly, November 15.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Denver, Colo., July 21-25, 1930.

American Dental Hygienists Association, Denver, Colo., July 21-25, 1930.

American Dental Society of Europe, Nice, France, April 21, 1930.

Australian Dental Association, Brisbane, July 7-12, 1930.

International Dental Federation, Paris, France, August, 1931.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

January (1930)

Pennsylvania (Midwinter), at Harrisburg (30-31).

April (1930)

Alabama, at Montgomery (15-17).
Connecticut, at Stamford (22-24).
New Jersey, at Asbury Park (April 30-May 2).

May (1930)

Maryland, at Baltimore (5-7).
Massachusetts, at Boston (5-9).
Michigan, at Detroit (5-7).
New York, at New York City (12-16).
North Carolina, at Asheville (5-8).
Pennsylvania, at Philadelphia (6-8).
Tennessee, at Nashville (13-15).
Texas, at Fort Worth (20-23).

Baltimore City Dental Society, Feb. 7-8, 1930.

University of Buffalo School of Dentistry Alumni Association, Feb. 26-28, 1930.

Central Pennsylvania Dental Society, Altoona, Feb. 26-28, 1930.

Chicago Dental Society, Midwinter Clinic, Jan. 13-15, 1930.

Dallas Midwinter Dental Clinic, Feb. 10-12, 1930.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Michigan, at Ann Arbor, January 6-11. J. W. Lyons, Secretary, 617 Dwight Bldg., Jackson.

North Dakota, at Fargo, January 14-17, Gilbert Moskau, Secretary, Grand Forks.

Oklahoma, at Oklahoma City, January 6-9. E. E. Sanger, Secretary, Yukon.

MICHIGAN STATE DENTAL SOCIETY

The next annual meeting of the Michigan State Dental Society will be held in Detroit, at the Hotel Statler, May 5-7.

WILLIAM R. DAVIS, *Secretary*,
Michigan Department of Health,
Lansing

MEETING OF DENTAL HYGIENISTS

The dental hygienists will hold a meeting during the Chicago Dental Society Midwinter Clinic. All hygienists are invited to attend. Please register promptly on arrival, at Room 412, Stevens Hotel. A luncheon will be held for the hygienists at the Stevens, Wednesday, January 15, promptly at 12 o'clock. A special exhibition will be given by the Dental Hygiene Bureau of the Chicago Department of Health in the Section on Mouth Hygiene, Wednesday afternoon, January 15. Please arrange to come to this meeting. It will be of unusual interest to all hygienists.

TEXAS STATE DENTAL SOCIETY

The Texas State Dental Society will hold its fiftieth annual convention at Fort Worth, May 20-23. A cordial invitation to attend is extended to all dentists who are members of

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

the American Dental Association. For information relative to exhibits, write W. H. Nugent, chairman, 713 Medical Arts Bldg., Fort Worth.

GEORGE H. MENGEL, *President,*
El Paso
J. G. FIFE, *Sec'y-Treas.,*
Medical Arts Bldg.,
Dallas

MIDWINTER CLINIC BALTIMORE CITY DENTAL SOCIETY

The fifth annual Midwinter Clinic of the Baltimore City Dental Society will be held, February 7-8, at the Lord Baltimore Hotel. U. G. Rickert of Ann Arbor, Mich., will present a clinic and discussion on "Oral Diagnosis." Dayton D. Campbell, of Kansas City, Mo., will give a clinic on "Full Dentures." Frank R. Kent, of Boston, Mass., will lecture and demonstrate on the subject of "Dental Economics." Albert J. Irving, of New York City, will give a clinic on "Gold Inlay Technic," paying particular attention to the sliced cavity preparation. The number who can subscribe to the clinic is limited to 200, and the fee is $15. Applications are accepted in the order in which they are received, until the quota has been filled. Checks should be made payable to Conrad Inman, treasurer, and mailed to Ethelbert Lovett, chairman of membership committee, 104 W. Madison Street, Baltimore.

HARRY B. MCCARTHY, *Chairman,*
Midwinter Clinic,
815 Medical Arts Building,
Baltimore.

UNIVERSITY OF BUFFALO SCHOOL OF DENTISTRY ALUMNI ASSOCIATION

The thirtieth annual meeting of the University of Buffalo, School of Dentistry, Alumni Association will be held in Buffalo at the Hotel Statler, Wednesday-Friday, February 26-28. As in the past, an attractive program by outstanding essayists and clinicians is being secured and this meeting should be one of extreme interest to the general practitioner. An excellent program of entertainment is being arranged. Any ethical practitioner is welcomed to register at the same.

LEON J. GOUCHAT,
Chairman of Publicity.

AMERICAN PUBLIC HEALTH ASSOCIATION

The fifty-ninth annual meeting of the American Public Health Association will be held in Fort Worth, Texas, during the week of Oct. 27, 1930, with the Hotel Texas as headquarters. The annual meetings of this oldest and strongest of public health organizations bring together for a week of scientific discussion all of the public health leaders of the continent. It is always the most important health convention of the year. Health officers, nurses, dietitians, sanitary engineers, child and industrial hygienists—all of the specialists that make up the public health profession—meet to consider their common problems. Each of the ten sections of the association—health officers, laboratory, vital statistics, public health engineering, public health nursing, public health education, food, drugs and nutrition, industrial hygiene, child hygiene and epidemiology—arrange an individual program and there are a number of general sessions to which the public is invited. Detailed programs of the Fort Worth meetings will be announced in the official publication of the association, *The American Journal of Public Health and the Nation's Health.* Further information may be obtained from the executive secretary, Homer N. Calver, 370 Seventh Avenue, New York City.

MARYLAND STATE DENTAL ASSOCIATION

The annual meeting of the Maryland State Dental Association will be held at the Hotel Belvedere, Baltimore, May 5-7. All members of the American Dental Association are cordially invited to attend the session.

NORVAL H. MCDONALD, *Secretary,*
614 Medical Arts Bldg.,
Baltimore.

ALPHA ZETA GAMMA DENTAL FRATERNITY

The sixth annual meeting of the Alpha Zeta Gamma Dental Fraternity will be held, January 13-14, at the Stevens Hotel, Chicago, in conjunction with the Midwinter Clinic of the Chicago Dental Society.

A. D. NEWBERGER, *Scribe,*
55 E. Washington St.,
Chicago, Ill.

AMERICAN DENTAL SOCIETY OF EUROPE

The next annual meeting of the American Dental Society of Europe will be held in the Negresco Hotel, Nice, France, April 21-23.

DAWSON BUCKLEY, *Secretary,*
25 Boulevard Victor Hugo,
Nice, France.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The American Dental Hygienists' Association will hold its seventh annual meeting in Denver, Colo., July 21-25.

AGNES G. MORRIS, *Secretary,*
886 Main St.,
Bridgeport, Conn.

NORTH PHILADELPHIA ASSOCIATION OF DENTAL SURGEONS

The twentieth anniversary of the North Philadelphia Association of Dental Surgeons will be celebrated with an all day meeting at the Hotel Majestic, Philadelphia, Wednesday, January 8. The profession is invited. The program is as follows: 10:45 a. m.: "Focal Infection from a Dentist's Standpoint," Earle C. Rice, with discussion by Judson Daland and G. Oram Ring. 12:00-2:00 p. m.: Luncheon. 2:00-6:00: Dental dealers' exhibit and clinics as follows: "Treatment of Vincent's Infection," Frederic James; "Technic for Full Denture Impression Taking, M. M. DeVan; "Technic for Denticoll Impressions," Franklin E. Jones; "Gysi Extra-Oral Technic for Full Denture Construction," Frank A. Fox; "Removal of Fractured Roots from the Alveoli and the Maxillary Sinuses," Agnew Irwin; "Proper Method of Developing Roentgen-Ray Films," Mugur Hagopian; "Preparation of a Corner Porcelain Inlay, Including the Baking and Cementing," Paul Simonsen; "Practical Helps in Operative Dentistry," Milton J. Waas; "Correct Technic for Taking Roentgenograms," LeRoy M. Ennis. 6:30: Banquet and entertainment.

AMERICAN DENTAL ASSOCIATION ADOPTS GROUP LIFE INSURANCE PLAN

The Board of Trustees of the American Dental Association has been investigating, for some time, the advisability of adopting a group life insurance policy for the benefit of its membership. The report was made by Homer Robison, chairman of the Insurance Committee, A. D. A., at the meeting of the Board of Trustees at Chicago, and was unanimously approved by them. The House of Delegates, at the Seventy-First Annual Session in Washington, D. C., confirmed the action of the Board of Trustees, Oct. 7, 1929, by unanimous approval. The plan also has the approval of the attorneys who represent the American Dental Association on all legal matters.

Application was made to an old line legal reserve life insurance company, through Shannon C. Douglass and Associates, brokers, Kansas City, Mo.

The insurance is available to all members of the Association not past age 65. No medical examinations will be required of any eligible person who is included at the time the insurance goes into effect. Twenty-five per cent of all eligible members are required to make application before a policy may be issued.

The plan provides $3,000 coverage for those members between the ages 18 and 60, inclusive, and $1,000 for those between the ages 61 and 65 inclusive. The full amount issued to any member may be retained by him, as long as he desires. Each member will be charged a flat premium per thousand of insurance, regardless of age. An individual policy will be issued to each person insured. All premiums will be paid by the insured members of the Association.

The full amount of the insurance will be paid to the beneficiary designated by the insured in event of death from any cause, or will be paid to the member in event he becomes totally and permanently disabled before reaching age 60. The benefits may be paid either in one sum or in installments, according to the desires of the member. All claims will be handled through the insurance brokers in Kansas City in order to make as prompt settlement as possible.

Provision is made that this insurance may be retained by any dentist as long as his membership is maintained in the American Dental Association. Conversion may be made, without examination, at any time the insured desires.

Complete detailed information has been perpared and sent to the entire membership. Herewith is a blank application.

The American Dental Association, through the efforts of the Insurance Committee, is one

of the first organizations of its kind to recognize that the present trend of doing business on a large scale has resulted in lowered cost to the members of organizations that use the strength of their membership for collective bargaining, and this power has been applied to secure such insurance at a cost lower than can be secured by an individual.

We are pleased to advise that, so far, the number of applications received has been very gratifying. As a matter of fact, at the present time, we are receiving a large number of applications daily, and we are hoping to have enough applications on hand to place this insurance in force on January 1, 1930. The many letters, complimentary to this group insurance plan, that we have received daily have pleased us greatly. The following quotation is an excerpt from the letter recently received from the dean of one of the largest universities on the west coast: "I think that your plan is an excellent one and consider it one of the most valuable contributions to the economic welfare of the profession made by any of the committees of the American Dental Association. It should help very materially to solve the relief problem."

If there is anything we can do to assist you at any time, do not hesitate to call upon us. Additional information will be presented through THE JOURNAL from time to time, as well as by circular letters.

FRED A. RICHMOND, *Insurance Secretary*,
305 Federal Reserve Life Ins. Bldg.,
Kansas City, Kans.

Dec. 11, 1929.

$3,000.00

FOR

$32.00 ANNUALLY

Insurance Offered

Ages	Amount	Cost
15 to 60	$3,000	$32.00
61 to 65	1,000	11.00

Send Application and Check to

Dr. Fred A. Richmond
Insurance Secretary, A. D. A.
Federal Reserve Life Bldg
KANSAS CITY, KANSAS

(Over)

INDIVIDUAL APPLICATION
TO THE
AMERICAN NATIONAL INSURANCE CO.
FOR GROUP INSURANCE WITH
THE AMERICAN DENTAL ASSOCIATION

FULL NAME (PRINT)
LAST FIRST MIDDLE
ADDRESS
STREET CITY STATE
DATE OF BIRTH MONTH DAY YEAR AGE SEX
FULL NAME OF BENEFICIARY RELATIONSHIP
ADDRESS OF BENEFICIARY
STREET CITY STATE
ARE YOU ACTIVE IN THE DENTAL PROFESSION?
ARE YOU IN GOOD HEALTH?
DATED 1929
APPLICANT'S FULL SIGNATURE

SOME RECENT BOOKS*

Available for Circulation from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

58 E. Washington St., Chicago, Ill.

American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929.
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928.
Barail, L. C.	High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.)
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929.
Berger, Adolph	Principles and technic of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Bilpodiwala, M. C.	Care of the teeth, or layman's handbook of dentistry. Bombay, India, Author, 1927.
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926.
Broomell, I. N., & Fischelis, Philipp	Anatomy and histology of the mouth and teeth. Philadelphia, Blakiston, 1925.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927.
Bunting, R. W.	A text-book of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926.
Burkhart, H. J.	Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927.

*Books may be borrowed by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume asked should accompany all requests for books. This will be refunded on return of books.

Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items Interest Pub. Co., 1929.
Cattell, Psyche	Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928.
Clapp, G. W.	Life and work of James Leon Williams. New York, Dental Digest, 1925.
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926.
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